DOCUMENT RESUME

ED 324 066 JC 900 513

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|---|---|
| TITLE | Improving Teaching and Learning through Classroom Based Research: Final Report. |
| INSTITUTION | Irvine Valley Coll., Irvine, CA.; Sacramento City Coll., Calif. |
| SPONS AGENCY | California Community Coll. Fund for Instructional Improvement. |
| PUB DATE | Oct 89 |
| NOTE | 203p.; For related documents, see JC 900 510-511. |
| PUB TYPE | Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160) |
| EDRS PRICE | MF01/PC09 Plus Postage. |
| DESCRIPTORS | *Classroom Research; Community Colleges; Course Evaluation; *Humanities Instruction; *Instructional Effectiveness; *Instructional Improvement; Learning Strategies; *Science Instruction; *Teaching Methods; Two Year Colleges |

ABSTRACT

A collection of reports on 12 classroom-based research projects is presented, representing the individual and collaborative efforts of faculty, advisors, and program coordinators from Sacramento City College and Irvine Valley College, California. First, a final report is presented on the Cooperative Classroom-Based Research project, including descriptive, evaluative, and financial information on this effort to improve teaching and learning through research on the effectiveness of instructional strategies. Next, the following 12 research reports are presented: (1) "Testing Strategies in Science to Measure Student Ability for Levels of Abstraction Work," by Jonathan Brosin; (2) "Student Analytical Ability in Biology," by K. Christopher Riegle; (3) "Is Writing an Effective Way to Learn Chemical Concepts?" by Naola VanOrden; (4) "A Second Look: Student Persistence and Achievement: An Evaluation of the Effects of an Extended Orientation Course," by Edwin Stupka; (5) "The MBTI (Myers-Briggs Type Indicator) in the College Writing Class," by Donovan Johnson; (6) "Partial Credit with Notes and Rework for Half Credit in Mathematics," by Richard Zucker; (7) "Electronic Music Literacy," by Janice Lynn Wyma; (8) "Dunham Dance Technique to Improve Student Preparedness for Dance," by Shirley Brown; (9) "A Comparison of Two Different Methods of Motivating Students to Improve Their Physical Fitness Levels," by Pam Deegan; (10) "Self-Definition as a Factor in Student Success," by Tonya Hilligoss; (11) "Videotaping of Speech Students," by Craig Grossman; and (12) "Videotaping of Speech Students," Kenneth J. Lynch. Evaluative data on the Cooperative Classroom Based Research Project is appended. (AYC)

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ED324066

# Sacramento City College
# Irvine Valley College

# Improving Teaching and Learning Through Classroom Based Research

# Final Report

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**Funding in part by The Fund For Instructional Improvement**
**California Community Colleges Chancellor's Office**

**October 1989**

SACRAMENTO CITY COLLEGE/IRVINE VALLEY COLLEGE

COOPERATIVE CLASSROOM BASED RESEARCH

FINAL REPORT

FUNDED IN PART BY THE CALIFORNIA COMMUNITY COLLEGE

FUND FOR INSTRUCTIONAL IMPROVEMENT

1988 - 1989

PROJECT TEAM

SACRAMENTO CITY COLLEGE

ADMINISTRATORS

Marguerite Jones

PROJECT COORDINATORS

Kirk Wiecking

RESEARCH ADVISORS

Gene Sellers

RESEARCH SPECIALIST

Larry Boese

SECRETARIES

Ann Moore

IRVINE VALLEY COLLEGE

ADMINISTRATORS

Clella Wood

PROJECT COORDINATORS

Janice Horn

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SECRETARIES

Joyce Bell

OCTOBER 1989

# SACRAMENTO CITY COLLEGE/IRVINE VALLEY COLLEGE

# COOPERATIVE CLASSROOM RESEARCH PROJECT

# FINAL REPORT

## RESEARCH FACULTY


| SACRAMENTO CITY COLLEGE | IRVINE VALLEY COLLEGE |
|---|---|
| Johnathan Brosin | Pam Deegan |
| Shirley Brown | Graig Grossman |
| Tonya Hilligoss | Donovan Johnson |
| Edwin Stupka | K. Christopher Riegle |
| Kenneth J. Lynch | Janice Lynn Wyma |
| Naola VanOrden | Richard Zucker |


OCTOBER 1989

SACRAMENTO CITY COLLEGE/IRVINE VALLEY COLLEGE
COOPERATIVE CLASSROOM BASED RESEARCH

## FOREWORD

This report on classroom based research represents the final results of a project supported in part by the California Community College Fund for Instructional Improvement during 1988-1989. The purpose of this project was to conduct 12 classroom based research studies in a collaborative manner between Sacramento City College and Irvine Valley College.

The intent of classroom based research is direct faculty participation in research to improve teaching and learning. It is based on the premise that instructors do have the opportunity, through research, to study, analyze, identify, implement, and assess instructional strategies that improve teaching and learning.

The results of this project serve as evidence of the dedication, professional expertise, and sincere desire of community college faculty to foster student success and to improve instruction. Each individual study clearly demonstrates a commitment to excellence in education and exemplifies the quality of community college instruction.

The material presented in this report represents individual and collaborative efforts of the research faculty, advisors, and coordinators from Sacramento City College and Irvine Valley College.

SACRAMENTO CITY COLLEGE/IRVINE VALLEY COLLEGE

COOPERATIVE CLASSROOM BASED RESEARCH

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CALIFORNIA COMMUNITY COLLEGE
CHANCELLOR'S OFFICE
FUND FOR INSTRUCTIONAL IMPROVEMENT

# FINAL REPORT
# FOR
# SACRAMENTO CITY COLLEGE/IRVINE VALLEY COLLEGE
# COOPERATIVE CLASSROOM BASED RESEARCH PROJECT
# 1988 - 89

1. Provide a brief description of the project and the activities which were actually carried out to bring the project to completion. If the project had to be adjusted due to reduced funds or other factors, describe the project in its adjusted form and not as originally described in your application for funding. Also specify when the project actually began and when it was actually completed.

The purpose of this project was to improve teaching and learning through classroom based research. It is based on the premise that careful analysis of instructional techniques, the classroom environment and student outcomes, through research, can have a positive impact on instructional improvement and foster faculty renewal.

Through a consortium effort between Sacramento City College and Irvine Valley College, the project goals included: 1) an increase in faculty trained to conduct classroom based research, 2) further development of classroom based research activity throughout the community college system, 3) additional resource materials and models on classroom based research for community college faculty, and 4) dissemination of results to encourage institutional interest in classroom research studies.

The major problems addressed in this project included: a) the lack of ongoing classroom research in the community college system; b) the challenge to provide educational excellence in teaching; c) the need to implement teaching strategies for improving instruction and learning; and d) the need to secure essential resources for faculty and staff renewal. The desired outcomes for this project consisted of: (a) an increase in faculty trained to conduct classroom research; (b) development and implementation of twelve classroom based research studies; (c) an increase in available resource materials for community college research; and (d) improved teaching, student success, and faculty development. The project was conducted on a cooperative basis using college advisory committees, and a collaborative project team with administrative, professional, and support staff from Sacramento City College and Irvine Valley College.

To implement this project, a series of activities were carried out to achieve specific objectives and to complete the project.

* Institutional project teams and adhoc advisory committees were established at each college to assist and advise project leaders in implementing the project. The committees were comprised of individuals representing various disciplines and levels of staff, i.e. management and faculty. The role of the committees was to provide recommendations for ensuring the success of the project and to generate ideas for classroom based research studies.

* A collaborative project team for coordination of project activities between Sacramento City College and Irvine Valley College was established, and was comprised of the following college representatives:

| | SCC | IVC |
|---|---|---|
| Administrators: | Marguerite Jones | Clella Wood |
| Directors: | Kirk Wiecking | Janice Horn |
| Research Advisors: | Gene Sellers | Jerry Rudmann |

Through telephone communication, written correspondence, and document exchange, the following tasks were carried out.

The grant proposal was reviewed at each college by appropriate staff and discussed by representatives from each campus to establish understanding and agreement on project goals, objectives, activities, evaluation components, implementation strategies, timelines, use of resources, and reporting requirements. Coordination and implementation activities included the following:

- o Review, adjustment, and agreement on project timelines
- o Discussion and agreement of general criteria for selecting classroom research studies
- o Recommendations for types of classroom studies appropriate to project intent
- o Review of strategies to promote and encourage faculty participation
- o Establishing coordination and communication procedures between the two colleges
- o Identifying roles and responsibilities of site project leaders and research advisors

- o Development of application procedures for faculty to conduct classroom research studies.

- o Exchange of reports, articles, and other information items on the concept and practice of classroom research

- o Discussion and agreement on research intent, scope, and design

- o Review, discussion, agreement on budget allocations and spending parameters

- o Selecting strategies to build faculty awareness through information dissemination, inservice meetings, and individual consultation.

In addition, previous classroom research projects and final report products produced by Sacramento City College were used as examples and provided recommended procedures for implementing this project

* Planning meetings were convened at each college, resources were identified and procedures outlined for project operations Committee members provided ideas on how best to implement this project to ensure campus wide participation and institutional acceptance and support. Recommendations were made for promoting participation and selecting faculty to conduct classroom based research studies (Exhibit A, Announcement and Application). Faculty applications for conducting classroom based research studies were reviewed, and select criteria was used to choose twelve faculty members to conduct the studies (six from each college). For the selection process, consideration was given to: a) appropriateness of the research proposal, b) feasibility and practicality of conducting the proposed study, c) diversity of proposed study compared with all applications, d) equitable representation of campus disciplines or topic issues, and e) thoroughness of the completed proposal.

* Inhouse research advisors, at each college, assisted with the application review process, and provided individual consultation to research faculty. Twelve faculty were selected to conduct the classroom based research studies (Exhibit B, List of Selected Projects). Faculty members also met as a group with the internal research advisors, and project leaders to review the conditions of the grant, to be advised about the operational procedures and support mechanisms, and to refine the scope of their individual studies.

* Twelve classroom research studies were conducted during Spring 1989. The primary activities to complete this objective consisted of one-to-one consultation sessions with internal research advisors and project directors at each college, and research faculty completing their tasks in the classroom. Individual meetings were held to ensure the progress of the study, to process and prepare necessary data, to address problems, and to discuss methods to handle data, analyze results, and write final reports for individual studies.

* Resource materials were gathered as part of the project. This was an ongoing process which consisted of reviewing information on the topic of classroom research distributing to participants, and compiling information and data related to the classroom research studies being conducted. Other materials consisted of data collected for the studies, and information on each individual study which includes a description of the study, an explanation of the activities carried out within the studies, presentation of results and analysis, limitations and/or problems with the study, and recommendations for replication and/or further investigation. Final reports for each study are contained in this report.

* In the Spring of 1989, a presentation on this research project was made at the 14th Annual California Association of Community Colleges Research Conference. Project staff from Sacramento City College and Irvine Valley College made a joint presentation. Representatives from over 75 community colleges were in attendance, and the response to the project was very positive. Many of the people expressed interest in learning more about the project, activities, and results for possible use at their institutions.

* Due to the positive response and continuing high level of interest in this project, staff in the Learning Resources Division at SCC prepared another grant proposal to secure funds for further development of classroom based research. A full proposal for a Phase III project was submitted to the California Community Colleges' Chancellor's Office, Fund for Instructional Improvement (1989-90). This proposal is intended to extend the practice of classroom based research studies to other community colleges beyond Sacramento City College by involving other college faculty in replicating previously conducted studies at Sacramento City College and also conducting new studies. In addition, the Staff Development Committee at SCC has funded three additional faculty to conduct classroom research studies during 1989-90. Irvine Valley College has also embraced the value of classroom research and is considering strategies for increasing faculty awareness and participation through flex days and Human Resource Development activities.

* An evaluation form (Exhibit C, Evaluation Instrument) was sent to each of the participating faculty on the project. A summary of the responses and other evaluative comments are reported in the evaluation section (Question #3) (see also, Exhibit D, Summary Evaluation) of this final report. Finally, as a result of the growing interest in classroom research Sacramento City College, in cooperation with the Northern California Research Group (NORCAL), co-sponsored an all day drive-in conference. This conference, " The Staff Development--Research Connection" provided a forum for community college personnel to learn more about the concept and practice of classroom research on a statewide basis. Over fifty participants from twenty-five colleges attended, and the response was very positive.

* Project results have been compiled for dissemination to promote replication. All information is packaged for distribution to California community colleges and other appropriate educational agencies and institutions.

* Adjustments to the original project included: 1) minimal budget reduction for benefits, absored by the colleges, and 2) a time extension for two months on the project completion date. This was necessary because of delays in receiving and processing the contract from the State Chancellor's Office. The project was initiated in October 1988 and completed in October 1989.

2. Provide a list and a copy of the final product of this project Although materials developed with funds from the California Community College Fund for Instructional Improvement may not be distributed for profit to California institutions, it is appropriate for such materials to be made available at cost of production.*

This final report as submitted in its present form is available upon request. Other materials that will be provided upon request include:

1) A copy of the application (1988-89) to the California Community College Chancellor's Office, Fund for Instructional Improvement to conduct this project on Classroom Based Research.

2) A copy of previous classroom research projects conducted at Sacramento City College including:

- Classroom Based Research Final Report 1985-1987 Sacramento City College Fund for Instructional Improvement Project

- Classroom Based Research Final Report 1987-88 Sacramento City College SCC Staff Development Project

* Under no circumstances should a charge be made for content of materials, only for the actual cost of paper or other material, copying expense, mailing, etc.

3. Provide a detailed evaluation of the project. This evaluation may require several pages and should include specific references to those project activities which you think were effective and those which were not effective. Include in your assessment of the project specific recommendations to those who may wish to replicate the project on their own campuses. The evaluation may have been carried out by project staff and/or an outside evaluation on the evaluation and the procedures.

The methods of evaluation used for this project were both process and product. Process evaluation was concerned with successful implementation of the project and evaluation of the project by the participants. Product evaluation was concerned with the results of the project as evident from the collection, development, and production of material resources. This includes support materials and documented project results.

The following narrative provides an analysis and evaluation of project activities and results.

* To begin the project, the first task was to establish institutional advisory committees and a collaborative project team. This was completed and consisted of diverse representation. This was a critical starting point since gaining institutional support and participation was important to ensure the success of the project.

  It should be noted that convening a large group of college staff with different schedules does present problems, and this is especially true at the beginning of a new school year. As a result, smaller more manageable committees were formed in lieu of a large committee.

* The next task was to reach agreement and adopt procedures for project operations. This phase was concerned with communications, logistics, protocols, operations, and setting a direction for the project. In consultation with the collaborative team and institutional committees, recommendations were provided as to what type of classroom based research activity would have the potential to be of the most benefit to the institution, faculty, and students. Since classroom research is still a new concept at the community college and because faculty awareness and interest is still growing, this aspect of the project generated considerable discussion and a diversity of ideas. The final result of these discussions was an agreement on the promotion of the project to encourage participation and suggested guidelines for selecting faculty participants to conduct classroom based research studies.

Logistics for the project were managed through the internal Staff Development Office at SCC and Office of Vocational Education at IVC, which enhanced the project operations since it was not necessary to create another college entity to oversee the project activities. This is an extremely important element for any project since reporting, coordination, and information dissemination can follow a regularly recognized institutional process.

Since the grant functions at each college are managed as part of an administrator's assignment with no clerical support for grant endeavors, the grant provision for funding clerical support was a very important aspect in ensuring the success of the project. In addition to routine correspondence and record keeping, the clerical support was instrumental for the on-going processing of information which was necessary to assist the research faculty to keep the research activity progressing. Also, this support allowed for the professional preparation of the final report.

* Announcing opportunities for faculty to apply to conduct classroom based research studies was the next phase in this project. This was achieved with minimal difficulty and, once the promotion efforts were initiated, it generated interest and discussion from many segments of the campus. Using examples from previous projects, a simple single page announcement and application form was used to solicit participation from the faculty. Based upon previous experience it was understood that making the application process simple would encourage faculty with all levels of expertise to respond. It was acknowledged that the concept of research had the potential for screening out very good ideas as some faculty might think they were not adequately prepared to conduct classroom research.

* Selecting research studies from the applications required advisory subcommittees to review and rank the applications and then to meet and discuss selection of the studies (see Exhibit F, Project Review Sheet). This task was completed with minimal difficulty. Previously established criteria facilitated the selection process. This criteria included 1) appropriateness of the proposed study, 2) feasibility and practicality of conducting the proposed study, 3) diversity of the proposed study compared with all applications, 4) equitable representation of campus disciplines or topic issues, and 5) thoroughness of the completed proposal. The assistance of the internal research advisor at each college was critical in this process. Personal letters were sent to each person who applied to conduct a study informing them of the outcome of the selection.

* Based upon previous experience it was understood that an internal research advisor available on a regular basis to offer on-going assistance was most beneficial and effective for research faculty.

  Comments from the research faculty support the practice to work with someone in-house, since assistance was immediately available on an as-needed basis. Research faculty appreciated and enjoyed the opportunity for impromptu meetings which allowed them to address issues of concern and then to proceed with the next phase of their study.

  Group discussion and individual consultation sessions among research faculty, project leaders, and the research advisors also proved to be a very worthwhile activity for the project. These sessions permitted for sharing of ideas, updates on progress, raising problems, finding solutions, advancing the work tasks, and provided a productive and stimulating environment for accomplishing individual tasks. The cross fertilization of ideas among various disciplines to improve teaching and learning was positive.

* Providing for the clerical needs of the research faculty was determined to be a significant factor in this project. Research faculty needed to have data compiled and presented in a manner that the advisor and faculty could work with in the analysis of the data. This support was identified as essential for the successful completion of the project. Quick processing maintained the momentum and high level of interest on the part of the faculty.

* The classroom research studies were conducted by each of the individual research faculty, and the results of their efforts are reflected in the individual papers included in this report. Problems and limitations identified in the faculty papers provide evaluative information on the study. In addition, the individual research reports serve as the final product of the classroom studies for an overall evaluation of the faculty work.

* Another item to be considered in evaluation of this project concerns the depth and quality of resource materials developed as a result of this project. The final report, faculty research papers, and other documentation serve as evidence of the value of the materials which resulted from the project. In addition, this complete final report provides useful information for anyone interested in learning more about classroom based research or interested in implementing of a research study.

* Overall, institutions concerned with implementing or replicating a project such as this should give careful attention to administrative leadership; careful scheduling due to the nature of research usually requiring a full term; adequate clerical assistance for research faculty; availability of an internal advisor/expert; and project coordination. Finally, institutional recognition and support is essential in order to gain faculty interest and continued participation.

* The Cooperative Classroom Research Project conducted with Sacramento City College and Irvine Valley College was a success. Although there may have been a few logistical problems, the final results certainly made the efforts most worthwhile. To improve teaching and learning, revitalize faculty, and to supplement staff development programs, Classroom Based Research is a demonstrated activity which has the potential to achieve these goals.

* When Sacramento City College faculty first began conducting classroom research in 1985, there was minimal activity in this area on a state wide basis. Since this time, and perhaps due to some of the dissemination efforts of Sacramento City College, the concept and practice of Classroom Research has continued to grow on a statewide basis.

  A major catalyst for this awareness must also be attributed to K. Patricia Cross and Thomas Angelo from the University of California at Berkeley. Their combined efforts in research, publishing and presenting on classroom research has contributed significantly to bringing this issue to the forefront of education.

  In a presentation by Dr. Cross titled "Improving Learning in Community Colleges" at the League for Innovation Conference on October 8, 1986 in Miami, Florida, she addresses the need for classroom research. She suggest that not just what is taught is important, but how it is taught is critical; that there will continue to be discussion as to what constitutes good or effective teaching, which has been based primarily on instructor ratings and not student outcomes; and that there is need to identify better measures and criteria for measuring quality education. In reviewing the need for improved methods or standards for evaluating the quality of instruction, Dr. Cross identifies three major factors which she indicates are <u>missing</u> from available literature.

First, information on what teachers are trying to accomplish, what they want students to learn from them, and what are they doing in the classroom. She suggest more attention should be given to what teachers are trying to do. Second, that there is a gap between research and practice because there is a need for a "constructive approach" to apply research to improve practice.

Dr. Cross suggests "that the exchange of knowledge from many specific classrooms will give teachers more useful insight into the teaching/learning process than the search for generalizations across a representative sample of students, teachers, and subject matters." Also, that knowledge gained from doing research is more likely to be used than what is gained from reading about research. The third item that is missing from the literature is on "how to conduct research in and on the classroom." Dr. Cross suggests that the most useful research will be done by teachers in their own classrooms. This approach will help the teacher to evaluate their effectiveness, foster intellectual stimulation, and will provide professional renewal for teachers.

Since 1986, Dr. Cross and Dr. Angelo have both been actively promoting classroom research in California Community Colleges and in higher education nationwide. They have published one book, Classroom Assessment Techniques, and are working on a second book which will contain examples of classroom research studies which are "discipline specific." Although the Sacramento City College and the Irvine Valley College studies do not exactly follow the Cross/Angelo model (although they have certainly influenced our direction) the results of these efforts will contribute to the information and resources available on classroom research.

Dr. Angelo and Dr. Cross have also established an institute at the University of California at Berkeley concerned with training faculty to conduct classroom research and how to train others. The first training session was held in 1989 and the project director for this grant was supported by Sacramento City College Human Resource Development funds to attend. As a result of the session, it became evident that many colleges are now becoming involved in classroom research, and many different types of institutional models for classroom research are evolving.

Clearly, classroom research studies, supported by the California Community Colleges Chancellor's Office, Fund for Instructional Improvement, are contributing to this growing body of knowledge.

* Through the initial Fund for Instructional Improvement grant (1985-87) awarded to Sacramento City College, we learned much about the concept of classroom research and the tremendous amount of work still to be accomplished. In addition, studies funded by the SCC Staff Development Committee (1987-88), and this most recent Fund for Instructional Improvement Project (1988-89) reinforce the fact that faculty are very interested in this concept and that they are willing to engage in classroom research with appropriate resources and assistance. Also, as a result of this most recent project, Sacramento City College will continue the support of classroom based research through internal Human Resource Development activity and work toward expanding the concept and practice through the most recent Fund for Instructional Improvement grant (1989-90). Also, Irvine Valley College will continue to promote and foster faculty involvement in classroom research through inservice/Flex instructional improvemnet activities and explore the potential of continued fiscal support through Human Resource Development plans and activities.

4. Provide a detailed itemization of budget expenditures during the period for which the project was funded. Use the budget summary attached to report expenditures. On a separate piece of paper explain how funds were spent within each of the budget categories.

1988-89 Fund For Instructional Improvement (FII)
Expenditure Statement

Sacramento City College/Irvine Valley College
Budget Detail

FII Funds

| | SCC | IVC | TOTAL |
|---|---|---|---|
| SALARIES | 6,000 | 6,000 | 12,000 |
| A. FACULTY STIPENDS<br><br>Paid one each $1,000. Stipend to twelve research faculty (six at SCC and six at IVC) for conducting classroom research and completion of paper on study. | | | |
| B. RESEARCH ADVISOR(S)<br><br>Compensation for time spent on project activities, such as individual consultation, assistance with research design, statistical treatments, analysis interpretation and presentation. | 2,111 | 1,732 | 3,843 |
| C. PROJECT DIRECTOR (S)<br><br>Compensation for time spent on project activities, such as, coordination, information dissemination, communication, assistance with preparation of studies, and completion of final report writing and editing. | 2,780 | 1,732 | 4,512 |

FII FUNDS

| | SCC | IVC | TOTAL |
|---|---|---|---|
| D. SECRETARIAL | 2,626 | 2,800 | 5,426 |
| Compensation for time spent on clerical activities, such as, typing project correspondence, faculty studies, and completed final report. Also, duplicating, graphics and maintaining budget accounts. | | | |
| SUPPLIES | | 300 | 300 |
| A. REFERENCE MATERIALS | | | |
| Funds expended for reference materials, books, abstracts and other print materials, such as, article reprints. | | | |
| B. INSTRUCTIONAL MATERIALS | | 500 | 500 |
| Funds expended for items such as, skills inventory and student analysis tests. | | | |
| C. OPERATIONS | 434 | 850 | 1,284 |
| Funds expended for items such as, paper, computer disks, ribbons, binders, graphic art material and duplication costs for faculty studies, and project final report. | | | |
| CONTRACT (SERVICES) | 200 | | 200 |
| Compensation for consultant assistance. | | | |

FII FUNDS

| | SCC | IVC | TOTAL |
|---|---|---|---|
| CONFERENCE, TRAVEL | 691 | 744 | 1,435 |
| Funds expended for air-fare, mileage, overnight accommodations/per diem expenses, conference registration for project participants to meet and confer, and conference presentation. | | | |
| TOTALS | 14,842 | 14,658 | 29,500 |

# 1988-89 FUND FOR INSTRUCTIONAL IMPROVEMENT (FII)

## Expenditure Statement

GRANT NO.: 88-0008

DISTRICT: Los Rios Community College District

ADDRESS: 1919 Spanos Court, Sacramento, CA 95825

**When Entering Dollar Amounts, Round off to Nearest Dollar**

| Object of Expenditure | Classification | Budgeted Amount | Expenditures* |
|---|---|---|---|
| 1100 | Teachers' Salaries | $ | $ |
| 1200 | Supervisors' Salaries | | |
| 1406 | Certificated Other Salaries | 4,599 | 4,599 |
| 2200 | Instructional Aides' Salaries | | |
| 2100 | Clerical Salaries | | |
| 2300 | Other Classified Salaries | 8,351 | 8,351 |
| 3000 | Employee Benefits | 567 | 567 |
| 4100 | Textbooks | | |
| 4200 | Other Books | | |
| 4XXX | Instructional Supplies | | |
| 4XXX | Media Supplies | | |
| 4XXX | Other Supplies | 434 | 434 |
| 4800 | Equipment Replacement (Loans only) | | |
| 5XXX | Contracts (Services) | 200 | 200 |
| 5XXX | Conference, Travel | 691 | 691 |
| 5XXX | Contracts, Rent | 14,658 | 14,658 |
| 5XXX | Utilities, Housekeeping | | |
| 6400 | Equipment Lease Purchase | | |
| | Total | $ 29,500 | $29,500 |

* Submit along with above information a paragraph explaining the expenditure (evidence of product and/or service).

**For Chancellor's Office Use Only**

FOR THE EXPENDITURES STATED ABOVE, I AUTHORIZE PAYMENT FOR:

Index-PCA Number: _____
Item Number: _____
Fiscal Year: _____
Object of Expenditure: _____
Claim Schedule No.: _____

# TESTING STRATEGIES IN SCIENCE TO MEASURE STUDENT ABILITY FOR LEVELS OF ABSTRACTION WORK

A RESEARCH PROJECT CONDUCTED BY
JONATHAN BROSIN
MATH, SCIENCE AND ENGINEERING DIVISION
SACRAMENTO CITY COLLEGE
SPRING SEMESTER 1989

## OVERVIEW

### Introduction

In the teaching of the sciences, there appears to be an increasing reliance on the use of objective, easily corrected examinations. Lecture sections comprised of several laboratory sections lead to large class sizes. The sheer volume of factual material is constantly growing. The combination of these factors militates for the use of an evaluation format which is conveniently concocted and graded. Most of the major textbook publishing houses are responding to the perceived pattern in testing procedures by providing instructors with already "canned" multiple choice examinations--some already on computer software allowing for easy item selection and arrangement. The same tests can be taken using electronically scored answer sheets. The entire process is quick, objective and efficient. Students learn to study in order to retain discreet bits (bytes?) of information. They can reasonably expect to get immediate results feedback. Although, for the most part students are happy with this sort of arrangement, some serious pedagogical issues are raised by the use of such examinations.

It is undeniable that the machine-scored multiple choice format is extraordinarily convenient. Not only is the problem of returning papers promptly solved, but the need to deliberate about such issues as partial credit for written answers is obviated. Still, the use of prefabricated examinations leads to some discomforting questions. One must determine whether the purchased examinations fit the course as taught. There may even be the frighteningly seductive tendency to revise the course content to fit the available test materials. There is also the concern whether any evaluation vehicle that is so constructed, even if the instructor constructs it him/herself, prompts the kind of reflective thought we hope our students will employ. The most basic concern is whether the multiple choice format which suits so many of our needs so well is the type of evaluative tool we truly feel comfortable with from an educational point of view. If, as presently employed, it is not, can it be revamped or should it be junked?

Objectives

The problem becomes one of choosing a method of evaluating student learning in a fair and repeatable fashion which also encourages the maximum degree of analytical thought on the part of the student. How is this accomplished within the constraints of time and breadth of material alluded to earlier in this discussion? What format will best serve the need of students to both retain specific information and engage in the synthesis of such material to solve problems?

Using anecdotal information drawn from discussions with former students, I have begun to believe that, as a general rule, multiple choice tests tend to narrow grade distributions. They do this by favoring the student with a shallow knowledge of the subject matter who will not read semantic nuances into the available answers. Students with a comprehensive knowledge of the subject are more likely to get caught in that sort of "nit picking." Further the format favors the truly poorly prepared student by increasing the element of chance, especially when at least one of the answer choices is silly or obviously wrong. In looking at publisher-supplied tests, this is very often the case. The reality of all multiple choice examinations is that a series of possible answers is presented, and one of them has got to be correct. The combined effects of chance and recognition of key words can only help the inadequately prepared student. That this format tends to hurt the well-prepared student is one of my assumptions, which may be arguable.

In recent years Innovation Abstracts has devoted a couple of issues to the problem of writing multiple choice questions. In particular one of these issues addressed designing questions that will elicit more complex processes than rote memory. Feeling uncomfortable with the almost exclusive use of multiple choice tests in large microbiology classes, I was taken with the idea of developing a method for testing reasoning processes as well as memory. If, in fact, it were possible to design such instruments, and they did reflect the ability to reason, the element of chance would be lessened. Further the students capable of drawing finer distinctions would be rewarded. My intent was to design multiple choice examination questions that would make the results more reflective of multi-dimensional learning. I felt that a corollary to this would be larger spreads of scores, and that the "good students" would be more effectively separated from the "bad students."

The first step in evaluating the hypothesis was to become adept at writing questions that required more than rote memory to obtain correct answers. The next major step was to find a vehicle for exploring response to such questions. Could a test be used to test itself as well as provide data for evaluation of student performance? Of course it was also necessary to locate a population upon whom to inflict the inquiry. The first problem involved significant self-teaching. All of the other concerns seemed to be suggested by the announcement of the Classroom Based Research Project at Sacramento City College.

## METHODOLOGY

At the initial stage of visualization of this project, I had intended to investigate the whole range of questions alluded to earlier in this report. Among them were:

1) Can greater levels of abstraction be achieved in multiple choice test questions?
2) Can tests using such questions maximize the demand for critical reading and thinking?
3) Can tests using such questions test the same abilities as essay tests?
4) Does this format broaden the performance spread?
5) Do better students perform more strongly on the more abstract questions, while poorer students do the opposite?
6) Is student performance repeatable?
7) Can answers to all of the above questions be clearly quantified?

As the project proceeded it became necessary to limit the scope of the inquiry somewhat. Also, as the experiment proceeded, some new questions became apparent. Perhaps a continuation of the work would allow for amplification of the as yet untreated original questions.

What I did choose to examine was the possibility of constructing questions that required more reasoning to arrive at correct answers and tracking the patterns of student performance on the different types of questions. As a sampling population I decided to use the set of students enrolled in my Biology 6 (beginning microbiology) class in Spring of 1989. This particular class provided a good test group, as the group was entirely self-selected with no prerequisites. Further the course material is very broad in nature, while still lending itself to deeper analysis. The class was overfilled, with others waiting to enroll, so I was able to explain to the class that they would be a test group in a classroom research project, and that, if they were uncomfortable with that, they could enroll in one of the other open sections of the same course.

They were also informed that, as participants in the project, they would be expected to render opinions both orally and in writing about the process itself. Parenthetically this did not cause any of the students to withdraw, nor did any of them drop the course during the semester, a very unusual retention pattern. The operating plan that I devised was to use the class as both a test group and a control group, giving them four tests. Two would be the standard types of multiple choice examinations given in past classes.
The other two would be carefully designed to include questions of varying degrees of complexity, all the while tracking student performance of the different types of questions.

For the purposes of this experiment I decided on four identifiable question types. A first (or type one) would be a simple word equivalency or definition type question. A second (type two) would also require a direct equivalent answer, not a definition, but essentially rote memory. A third (type three) set would involve a reasoning process from recall of a fact to devising an answer. The fourth (type four) would involve more abstraction, requiring the student to draw on separated (in delivery) pieces of information to synthesize an answer. Examples of the question types alluded to here may be found in Appendix 1. The first examination given would be a traditional test, comprised almost entirely (as are most multiple choice tests) of type one and two questions. The second and third examinations would be comprised of a mix of all four types of questions, especially written for this experiment to meet the stated criteria. The last (or fourth) examination was originally planned to use an essay format. Unfortunately, the material did not lend itself to such a treatment, being mostly the identification of a number of diseases and their causative agents. I eventually chose to revise the plan to use a format very similar to the first test for the fourth one, as the nature of the information fit that design best. At that point I also found I needed input from the students as to their own feelings about the project and their reactions to it. All of the examinations had approximately the same number of questions and point total values.

The first examination, as explained, was compiled in the traditional way. The questions were drawn from a bank of previously used and retained ones along with some found in the Teacher's Guide to the text[1] and some devised newly but in traditional fashion by me. This examination was to be used as a control against which to measure the next two.

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[1]. Alcamo, I. Edward, Fundamentals of Microbiology. 1987, Benjamin/Cummings, Menlo Park, California.

Further it was used to place the class members into three groups on the basis of performance. The second examination raw totals were added to those to give final conformation to the groupings. The groups were designated A, B, and C, with A being those who scored best down to C, those who scored worst. Groups A and C included 11 members each, while Group B had 8 members. It is interesting to note that there was almost no movement out of the initial groupings when looking at cumulative point totals throughout the semester. The second and third examinations were designed with questions specifically designed to meet the experimental criteria. The question types were distributed over the range of material being addressed and were presented randomly though the test blanks. I had previously identified for my own use, of course, the placement of questions in my hierarchical ranking. When the exams were scored, using the Scan-tron system, item analyses were used to obtain data on performance on the different types of questions, and the papers were segregated into the Groups to correlate performance data to the "student types." The raw data were used to run Chi square tests, and percent figures were taken to give more visible meaning to the results. (See graphs in the next section.)

An element of this type of design which was not anticipated was the human one. I had attempted to design this like a classical scientific experiment. This does not take into account that there would be an uncontrolled (uncontrollable?) variable in the field. The students were not immutable objects which would simply behave uniformly regardless of the process in which they were immersed. The fact that they did not remind me that one can't view humans as thinking machines raised some interesting issues in attempting to understand the experimental results.

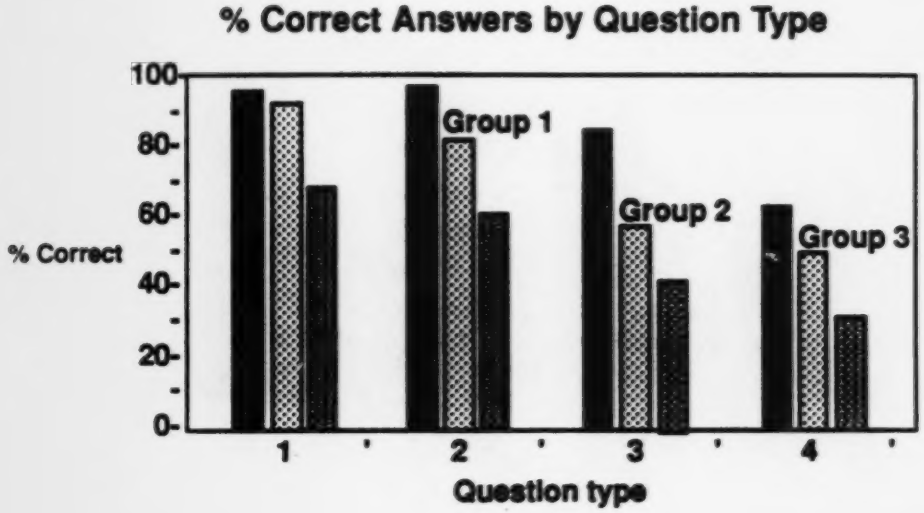
## FINDINGS

### Results

As planned the first examination set a workable base line for the next two. The second produced results which appeared to confirm the hypothesis insofar as the affect on spread was concerned. The following grid summarizes results by percentage of correct answers to question types within student groups:

| | Student Groups | | |
|---|---|---|---|
| Question Type | A % right | B % right | C % right |
| 1 | 94 | 91 | 63 |
| 2 | 96 | 77 | 59 |
| 3 | 83 | 55 | 41 |
| 4 | 62 | 47 | 31 |

As can be seen Group A performed better in every category, with Group B following, and Group C falling further behind. Aside from this obvious and rather predictable outcome, another series of interesting inferences may be drawn. Note that the difference between Group A's performance on the two types of memory questions (1 and 2) is almost identical, whereas there is a much more notable difference with Group B. Further, if the first two types of questions (memory questions ) are lumped together, and the second two types of questions (thought questions) are lumped, the contrast between groups appears more striking; Group A shows an initial 95% dropping to 75%. Group B shows 83% dropping to 52%; while Group C begins with 60% dropping to 37%. The overall results, as portrayed in the table, can also be shown graphically:




(Substitute group numbers for letters, i.e., 1=A, 2=B, 3=C.)

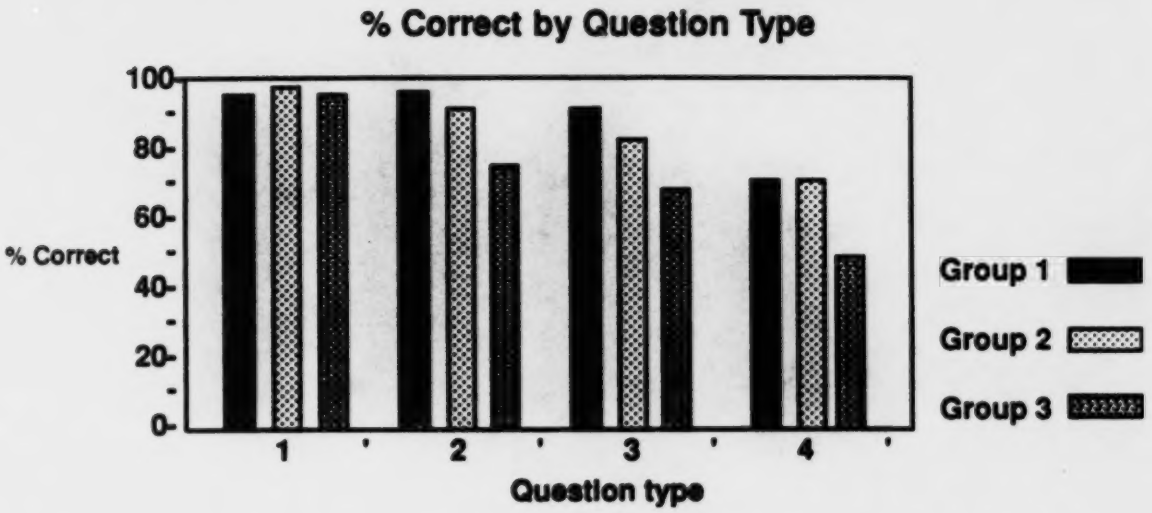
A Chi Square test run on the set of raw scores confirms that there was a statistically significant difference between the performance of the student groups on the question types. The raw data themselves showed that the results were spread more than in the first test. Further the performance within Groups on the identified question types supported the hypothesis that "better" students would perform better on more complex questions, and vice-versa.

The third examination was constructed and administered in a fashion essentially identical to that of the second. The significant uncontrolled variable in this case was that the students had an intimation of the type of questions they might face, which they had not had prior to the second test. They had also been participants in a discussion of the test contents and results, including explanations as to how correct answers were arrived at. The results presented as composite percentages are shown in the following table:

| Question Type | A % right | B % right | C % right |
|---|---|---|---|
| 1 | 95 | 98 | 94 |
| 2 | 95 | 90 | 70 |
| 3 | 90 | 80 | 66 |
| 4 | 71 | 70 | 48 |

As can be seen the student groups again performed in rank. However, the gaps between A and B narrowed noticeably, with the anomalous better performance by the B Group on type 1 (definition) questions. The overall improved performance on the third test compared to the second is readily noticed. The spread is still significant, particularly between Group A and Group C. Anecdotally there were some students in middle Group who outperformed some in the A Group. This had not occurred on the previous test. It is interesting to note that, as in the previous test, there was almost no difference between performance on type 1 and type 2 questions in Group A. Contrasts in overall performance are seen somewhat more clearly when the first two (memory) question types are lumped together and the type 3 and 4 (thought) questions are combined. Group A scores a composite 95% and drops to 85%; Group B begins with a 92% and drops to a 78%; finally Group C initially scores a 75%, dropping to a 62%. The differences in the lumped scores within groups are only about 1/2 what they were on the previous examination.

The overall set of raw data segregated by Group and question type, when submitted to a Chi Square test did not prove to be significantly different. The "tightening" of the scores can perhaps be seen more clearly by looking at a bar graph:




(Substitute group numbers for letters as in the previous graph.)

The fact that this trial was nowhere near as definitive as the last led to some difficult questions. Was the performance on the previous examination just a chance occurrence? Was the underlying premise flawed? Is there really no way to make multiple tests more intellectually challenging? At this point it occurred to me that there was a significant element in the design that was not being considered. The students played a very dynamic role in the experiment. They were not passive objects in an externally controlled system. I decided to make a systematic attempt to get in touch with their response to the situation.

I designed a questionnaire to attempt to get at the nature of student views of the project. The questionnaire is included in Appendix 2. Along with the fourth and last examination students were required to respond to the questionnaire anonymously and to return it separately from the answer sheets. I scored and quantified the answers in order to see if there might be some explanations to the questions raised by the previous examination's results.

The responses gave some insight into the student performance on examinations. The strongest positive response on the questionnaire indicated that students were surprised at the difficulty of the second examination. An almost equally strong positive response indicated that students felt that some of the questions on the second examination had been especially written to be difficult. Interestingly a significantly weaker positive response was elicited when an identical question was asked about the third examination. Questions that indicated that students had studied more intensely for the third examination in light of their difficulty with the second examination gained strong affirmative responses, although not as strong as the ones simply affirming the difficulty of that examination. Finally students responded rather neutrally to questions which asked them whether the "more difficult" questions had a positive effect by forcing them to think harder and whether these questions were similar to essay questions in effect.

One would infer from these student responses that one outcome of the encounter with the specially designed questions of the second test was that students, whether they did so consciously or not, prepared differently for the next test. The questions were not open-ended enough to elicit how their preparation differed, but "harder" and more "carefully" were suggested. The test results would seem to confirm those student perceptions. Although few students took advantage of the opportunity to write further comments (five of thirty), among those who did, a common theme was that they "figured out" what the "trick" or "gimmick" (my word not theirs) was. One student, on the other hand, commented that the second examination had caused her to take the course "more seriously." This student, one who described herself as a "B student" previously, improved steadily and earned an A. The overall picture of these students is that of a population that was onto the fact that the teacher was up to something and were going to respond to that.

## SUMMARY

### Discussion

When this project was first envisioned, a vast and inclusive set of inquiries was entertained. What had begun with a dalliance over the improvement of multiple choice type questions had grown into an interest in re-evaluating the whole testing process. By creating better questions, we could transform student evaluation to new levels of intellectual subtlety, while improving the quantification of learning. Like many somewhat presumptuous and overambitious schemes, this undertaking was to undergo some major revisions, both at the inception and while in progress.

The earliest and most demanding (on the part of the investigator) portion of the project remained a central focus. That is, is it possible to devise on a large scale multiple choice questions that require serious critical thinking? I had already begun to work with this challenge when I became aware of and involved with the Classroom Based Research Project. Drawing on discussions I had read in brief in Innovation Abstracts (Thanks to the Staff Development Office), I had begun to develop a hierarchy of question types. The idea was to present multiple choice questions that called on the depth of understanding that can be elicited in essay formats. I have concluded multiple choice questions that require serious thought can be written. The data from this experiment support the hypothesis that such questions will yield finer distinctions in the quality of student performance. In learning both from writing these questions and from evaluating student responses, I came to realize that these questions are somewhat different from what I had originally envisioned. They are (as the data show) more difficult because they force students to engage in more analysis and/or synthesis. In the past the best way I knew to write a hard multiple choice questions was to focus on a more obscure piece of factual information, for example, ask for the causative organism of tsutsugamushi fever as opposed to that for malaria. What I had seen others do was to use more involved question syntax or use a format in which any combination of answer options might be correct. My objective in this situation was to draw on more reasoning power. I feel confident that I succeeded often, and that this process can be replicated in the future. What did not occur was the creation of multiple choice questions that were somehow equivalent to essay questions. No matter what the level of abstraction or what inductive powers these questions evoke, they cannot substitute for the process of rendering an intellectual judgment and, through reasoned argument, defending it. I do not wish to negate the importance of using multiple choice questions with high levels of abstraction, but they must not be seen as a substitute for essays.

Another original objective of this investigation was to use the new question format as a vehicle for enhancing distinctions between "better students" and not so good students--broadening the test score distribution. The first examination using the experimental format did rather dramatically accentuate the extremes of performance. High scoring students continued to score high with less dropoff on the more abstract questions, while less apt students performed significantly poorer, particularly on the analysis-oriented questions. The second trial of this format, however, forced some re-evaluation. Although the general pattern of the first examination was followed, the overall response to the new questions types improved, and the distinctions between the student groups was much less marked. My original response to this was disappointment that my original hypothesis was taking a beating.

I have come to realize, however, that two (perhaps more, as I have time to reflect) very important messages might be inferred from this set of events.

A classroom based experiment differs significantly from a scientific laboratory experiment. The rigorous controls that can be enforced in the latter are not applicable in the former. Specifically students do not remain the same fixed points that would delight an experimental physicist. They are determined to play an active role in their educational experience. If the teacher changes some of the variables, well, so can they. If the teacher wants to throw "trick questions" into the melange, they'll just figure out his bag of tricks. Although the students were informed that they were part of a research project, and that it involved testing, they were never informed of the precise nature of the investigation. Still, after one exposure to the new testing format, these students showed themselves better prepared for a replay. They seemed to realize intuitively how the variables were being shifted and responded accordingly. I should add here that this class population is made up largely of students who wish to enter the nursing or dental hygiene programs and is highly motivated academically.

Having observed the student response to this new type of question format, an unanticipated but interesting corollary has become apparent. The student response was to out-think the exam. In order to do that, they were forced to learn the material more intensively. Given this reality, we can see that the new approach to test questions acted as an effective prod to learning. Not only did students look at material more, they looked at it in new ways. They were rewarded not just for memory, but for reasoning from the information itself. An interesting bit of information is that this class performed noticeably better on the final examination than had previous classes on a very similar final. I interpret that as further evidence that the experiment in testing acted as an impetus to learn more and to learn better. A footnote to this realization is that the instructor is called upon to provide paradigms for processing the information more effectively. So the teacher expands his/her set of pedagogical skills not only as a test-writer but as an analyst and synthesizer of material in order to be a learning exemplum.

Given the results of this investigation, I am strongly motivated to continue to hone the test building techniques used. The fashioning of more abstract questions is by itself an interesting intellectual exercise which helps to sharpen my own pedagogical skills. It is also exceedingly gratifying to see that students may be prompted by the test format to deal with cognitive content in new and more self-expanding ways. I would hope that this one experience is a harbinger of new learning/teaching possibilities opening, and that these may be broadened by further refinement of the techniques used in this project.

## APPENDIX 1

The following are examples of four hypothetical questions that could be written at each of the levels used to deal with the same information:

1. Cells lacking a true nucleus are _____ cells.

   a. eukaryotic

   b. karyotypic

   c. prokaryotic

   d. pseudokaryotic

2. Which of the following is an example of a prokaryotic cell?

   a. ameba

   b. eukaryotic

   c. sperm

   d. yeast

   e. none of these

3. The nuclear material of prokaryotic cells is found as:

   a. a single double-stranded chromosome

   b. plasmid DNA

   c. a pair of double stranded chromosomes

   d. a and b

   e. a, b, and c

4. The overwhelming majority of prokaryotic cell lines are clones because:

   a. They depend on plasmid DNA.

   b. They contain only mitochondrial DNA.

   c. They lack a true nucleus.

   d. They lack systematic genetic recombination.

   e. All of the above.

The following are four questions employing the test format actually used in an examination:

1. The human body produces the specific protein _____ to defend against viral replication.

   a. neuraminidase

   b. interferon

   c. immunoglobulin

   d. DNA polymerase

2. Fungi are classified into major groupings on the basis of their

   a. color

   b. size

   c. cell infrastructure

   d. spore type

3. The treatment of fungal diseases is complicated by

   a. the fact that fungi are eukaryotic

   b. the makeup of the fungal cell wall

   c. the makeup of the fungal cell membrane

   d. the fact that most fungi are saprobic

4. Viruses present a greater threat to human health than do fungi because

   a. viruses are non-cellular

   b. viruses are obligate parasites

   c. viruses show a very high rate of mutation

   d. a and b

   e. a and c

## APPENDIX 2

### TEST QUESTIONNAIRE

Along with the examination itself, fill out and return this questionnaire describing your reactions to the previous two tests you took in this class. Please answer as honestly as you can. If you think further comments are appropriate, write them at the bottom of this page. Do not put your name on this sheet. Thank you for helping with this project, of which you have been a part.

Circle the most correct response with 5 being "strongly agree," down to 1, being "don't agree at all."

1. I felt surprised at how difficult the second test was.

   5 4 3 2 1

2. Because of the difficulty of the second test, I studied especially hard for the third test.

   5 4 3 2 1

3. I felt some of the questions on the second test had been designed to be unusually difficult.

   5 4 3 2 1

4. I studies especially carefully for the third test, anticipating questions designed for unusual difficulty.

   5 4 3 2 1

5. I felt that some of the questions on the third test had been designed to be unusually difficult

   5 4 3 2 1

6. I felt that the third test was difficult, but that I was better prepared for the difficult questions than on the second test.

   5 4 3 2 1

7. I feel that the more difficult questions are better because they force me to think through my answers more thoroughly.

   5 4 3 2 1

8. I feel that the more difficult questions are less fair because they go beyond the way the material was presented.

   5 4 3 2 1

9. In some ways, the more difficult questions remind me of the way essay questions work.

   5 4 3 2 1

# STUDENT ANALYTICAL ABILITY IN BIOLOGY

A RESEARCH PROJECT CONDUCTED BY
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SPRING SEMESTER 1989

## OVERVIEW

Science courses have often been perceived, and indeed, taught as fact-based endeavors. As a result, examinations have most often been fact based. While it is true that the scientific paradigm requires theory to be based on verifiable observation, the essence of science is the creative activity of hypothesis formulation and testing through inductive and deductive reasoning. A student who learns science should not only be able to consume the facts (observations) of the discipline, but should be capable of creating or at least understanding inferences made from sets of data (observations) and deducing specific implications from theoretical statements - both activities being key components of critical thinking.

Writing is an essential element in the teaching and testing of critical thinking in the sciences. It is fairly easy for students to memorize the meaning of a term; but most often they cannot use the word in the context of a sentence. This failure is due, in part, to the fact that students do not learn a word primarily by definition but rather by the context in which the word is used. Writing forces students to put the new words they are learning into the context of sentences. In doing so they must decide how the words they have learned correlate with other words in their vocabulary as well as other words they are learning; in addition, they must decide whether the word is a noun, verb, adjective, adverb, etc. This process of sentence formulation usually makes it obvious, to the students and to me, that the students understand the meaning of a new word. Beyond learning simply the meanings of words, students must be capable of understanding concepts and theorizes created with these words. In describing, analyzing, explaining or supporting a scientific concept, students must create large numbers of sentences which relate to each other and the central concept. This activity not only forces them to recognize the relationships of new words to other words within a sentence but to recognize relationships of groups of words to one another. Thus, a primary objective of all science courses should be to get students to write about the material they are learning.

Writing through essay examination is also a most important method for evaluation of a student's understanding of and ability to analyze new material. This form of expression requires that students integrate learned 'facts' into cohesive patterns which support specific scientific contentions. Certain practical problems arise when this mode of testing is used. The most obvious problem is the tremendous amount of work required of the instructor who must read the exams. A second problem is the limited amount of material which an exam can cover given the amount of time necessary for students to formulate and write answers. A third, perhaps less obvious, problem involves the training required to clearly express ideas and support them with information. Since each discipline employs different theories, different forms of information gathering, different techniques for data analysis, etc., students must learn the peculiarities of each discipline before they become adept at the process of analysis in that discipline. Whereas much of the technique required in a general biology class may transfer directly to an advanced biology course, it may well not <u>obviously</u> transfer to a history class, or an art appreciation course. And, whereas, many of us with advanced degrees may readily see that the thought processes used for analysis in one discipline are directly applicable to other arenas in education, lower division students most often fail to grasp this. It is our job in part to train them in this regard.

Finally, it is my experience that most lower division students faced with essay examinations which force them to formulate information into cohesive arguments do poorly in the time allotted during an examination. They are good at facts; but formulation of a cohesive essay using those facts is considerably more difficult without substantial training. Additionally, when faced with multiple choice questions which require analysis of given facts to arrive at an appropriate conclusion, they do not do very well.

Often exams intended for lower division science courses (and perhaps courses in other disciplines) tend toward fact based "Pavlovian" questions which only require students to recognize previously experienced information; few of the questions require much analytical thinking. The end result of this practice is that students leave such courses with a few pieces of information but with no cohesive understanding of the nature of the discipline and its theoretical framework.

In recent years I have developed a technique (though likely not original) which requires students to write about new information and in doing so assists them in answering essay questions and difficult multiple choice questions on exams. The technique was initiated with the formulation of a list of essay questions for each unit (usually four weeks) of a course.

These questions were broad-based and the concepts which they emphasized were the primary focus of weekly lectures; thus lectures were designed to answer these broad-based questions. Each question required students to analyze basic theories, concepts, etc., based on the information presented in class and in the reading assignments. The primary problem which arose with this approach was that many students, especially those who needed the most help understanding the material, had difficulty analyzing the questions so they could formulate quality answers. This problem led to the inclusion of subquestions for each essay; the intention was to give students some direction with regard to the appropriate answer without giving them the answer. This strategy helped but still did not produce the desired result of quality answers on exams nor increased ability to analyze difficult multiple choice questions. Finally, I proposed that any student who wished to outline or write an answer to an essay question could submit it to me for critique. I read these answers and discussed them with the student. The results have been, I think, encouraging.

The purpose of this study is to test the validity of my contention that the assignment of essays to students, and the subsequent critique of the written answers with the instructor prior to examination actually helps the student succeed on the exam. Whereas it is obvious that writing the essay and reviewing the answer with the instructor before the exam should definitely help students to write better essays, I propose that they are also more successful with answers to multiple choice questions.

Hypothesis

Students who write pre-assigned essay questions and subsequently discuss them with the instructor prior to the exam achieve higher scores on multiple choice exam questions related to those essays than students who do not.

## METHODOLOGY

### Control and Experimental Groups

To test the hypothesis, control and experimental groups of students were designated. These groups had the following characteristics in common:

1. both groups contained students enrolled in a Biology 1 lecture course;

2. both groups were provided with 4-5 essay questions three weeks prior to each exam;

3. both groups were given four exams consisting of a single essay and 50 multiple choice questions which pertained to the essay questions;
4. the number of correct multiple choice questions on each exam was recorded for each student in the group.

The following criteria applied to the experimental group only:

1. students in this group took the first exam without the benefit of essay review so this exam could be used for comparison purposes;

2. students in this group were required to write at least one of the essays and review it with the instructor in person before the exam;

3. students were given five (5) extra points for each additional essay question they wrote and had reviewed in order to encourage participation;

4. only students who wrote more than one essay were included in the essay writing group for analysis.

Data Analysis

The multiple choice scores of the control and experimental groups were compared using a t-test for independent groups. The following comparisons were made:

1. Comparison of the control and experimental groups using exam 1 multiple choice scores to test for initial group equivalency;

2. Comparison of the non-withdrawal students remaining in the control and experimental groups at exams 2, 3, and 4 using the multiple choice scores on exam 1 as a baseline; the purpose of these comparisons was to test for group equivalency as the groups changed through the semester due to student drops;

3. Comparison of the multiple choice scores of control and experimental groups using scores from exams 2, 3, and 4;

4. Comparison essay writers to the non-essay writers within the experimental group; this comparison was necessary because not all students in the experimental group wrote essays even though it was required;

5. Comparison of the essay writers to the non-essay writers for each exam using the scores those students achieved on the first exam for comparison.

Limitations

Four major weaknesses appeared in the design as the research progressed. First, the equivalency of the initial groups was a problem with which to contend. Second, as the semester progressed, the composition of the initial groups changed as students dropped. Third, not all students in the initial experimental group were cooperative: some students wrote essays while others did not; and the composition of the essay writing group changed from exam to exam. Fourth, the sample size decreased during the semester; the smaller group sizes with large variances made statistical distinction more difficult.

FINDINGS

The control (C) and experimental (E) groups were not initially identical. The experimental group initially scored higher on the first exam (Table 1). As the composition of the two groups (C and E) changed during the semester, the students remaining in each group at exams 2, 3, and 4, were judged to be equivalent using exam 1 scores for comparison (Table 1). This allowed for valid comparisons between the control and experimental groups using data for exams 2-4.

Analysis of the student populations in the control and experimental groups at the end of the semester showed them to be statistically equivalent if the original exam 1 scores were used (Table 2). Individuals who dropped out of the C group scored significantly lower in exam 1 than the C group individuals who finished the course. Thus the final C group contained more high scoring individuals than it initially had. Such was not the case with the experimental group (Table 2); its composition did not change significantly during the semester using exam 1 scores as a basis for assessment. In addition, the E group had a much lower drop rate (28%) than the C group (44%).

A summary of the between and within group comparisons is given in Table 3. Comparison of the C and E groups showed that the experimental group performed better on the initial exam but the control group performed significantly better on exam 4. Preliminary analysis indicated that writing a single essay was of little help to the student while writing 2 or more essays helped significantly. For this reason only those students writing 2 or more essays were included in the experimental writing group for analysis purposes. Although no significant difference between the essay writers and the non-essay writers in the E group could be demonstrated on any exam, close inspection of the data (Tables 4-6 and Figures 1 and 2) shows clearly that the average score of the essay writers was always higher than the non-essay writers.

Since the C and E groups who took exams 2, 3, and 4 were equivalent, using exam 1 scores for comparison, the non-essay writers in the experimental group (EN) were pooled with the C group to create a non-essay writing population (C+EN). The essay writers in the experimental group (EW) performed significantly better on multiple choice questions than the pooled non-essay writers (C+EN) on exams 2 and 3; no significant difference between these two groups could be demonstrated for exam 4.

The statistics for the within and between group comparisons for exams 2, 3, and 4 are given in Tables 4-6 and Figures 1 and 2.

## SUMMARY

A number of problems with this research make assessment of the outcome limited. Among these problems were the changing composition of the experimental and control groups, the decreasing size of the sample populations, the small sample of essay writers in the experimental group, and the large variation in exam scores. However, the pooling of the control group and non-essay writers (0-1 essays) from the experimental group for comparison with the essay writers (2-4 essays) in the experimental group provided some positive evidence to support the hypothesis. In addition, the outcome of data analysis suggests at least two benefits of this technique which were not necessarily anticipated.

It is clear that the group which had to write essays and come to the instructor's office to discuss their answers had far fewer drop outs than the control group (28% as compared to 44%). Additionally, it appears that the students who dropped out of the control group were the students who performed poorly on the first exam; this was statistically significant. The students who dropped out of the experimental group were not necessarily students who performed poorly on the first exam. These results suggest that the activity of essay writing and in-person discussion had a positive effect on retention; perhaps especially on retention of students who had a lower chance of completing the course, judging from their initial exam scores.

The results achieved by the essay writers on exams 2 and 3 indicate a significantly better performance on multiple choice questions than achieved by the pooled non-essay writers (C+EN). This is especially poignant since the population of essay writers changed for each exam, and the students who wrote essays on these exams did not perform significantly higher than non-writers on exam 1; the writer and non-writers performed equally at the outset of the course.

The most peculiar result of this analysis is that the control group actually outperformed the experimental group on exam 4. Initially this result was puzzling; but close inspection of the data and the student groups suggested a reason. The control group performance improved with each exam; this result was due primarily to the withdrawal of students who performed poorly on the first exam. The remaining 54% of the original control population consisted of individuals who had performed significantly higher than the drop outs on the first exam. So, of course, the chance of this group performing better on the final exam was high. Pooling of the control group with the non-writers from the experimental group resulted in no significant difference between the writers and non-writers. This result would tend to negate the results for exams 2 and 3. Review of the grade records showed that the essay writing population who took the final exam included mostly students who were desperate for points in order to pass the course; these were students who had not written essays on the other exams and had performed poorly. If these results are valid, the essay writing helped the poorer students improve their performance on the final exam.

While the results of this study are far from overwhelming, they are encouraging. They indicate that writing 2 or more of the suggested essays made a significant difference in the performance of students on the multiple choice portion of the Biology 1 exams. And this activity of writing and visiting the instructor's office had a significant impact on retention. An additional effect not obvious from analysis of multiple choice scores is that students write significantly better essays on their exams. The students receive a higher score for the essay and the instructor is delighted to read something other than garbled bits of information with no cohesion. I really think it helps to develop critical thinking skills by forcing students to organize, analyze, synthesize, and express information, concepts and theories presented in class.

I feel the potential for this technique is significant. Changes in the Education Code due to AB1725 make examination by essay a reality. In addition, new emphasis on the development and demonstration of critical thinking ability make improved teaching techniques and methods a must. Certainly, a repeat of this study would be useful for further evaluation of the technique and its results.

TABLE I

Comparison of Control (C) and Experimental (E) Groups Using Exam 1 Scores on Multiple Choice Questions as a Data Base.

The exam 1 scores for students remaining in the control group (non-dropouts) at exams 2, 3, and 4 were compared to non-dropout students in the experimental group at exams 2, 3, and 4 respectively. (+) significant at P> 0.95; (NS) not significant.

| | EXAM 1 | | EXAM 2 | | EXAM 3 | | EXAM 4 | |
|---|---|---|---|---|---|---|---|---|
| | (C) | (E) | (C) | (E) | (C) | (E) | (C) | (E) |
| X | 29.02 | 33.08 | 30.06 | 33.24 | 32.46 | 34.59 | 33.44 | 34.45 |
| N | 45 | 25 | 34 | 21 | 26 | 17 | 26 | 20 |
| S.D. | 8.45 | 5.87 | 8.06 | 5.91 | 8.01 | 5.59 | 7.26 | 5.46 |
| Comp.* (C)/(E) | + | | NS | | NS | | NS | |

*Comparison

TABLE 2

Characteristics of the Control (C) Group and Experimental (E) Group Using Totals and Subgroups Who Finished the Course (F) and Who Withdrew (W) Prior to the Final Exam

Results are based upon the number of correct multiple choice questions on Exam 1 for which both groups were treated as controls.

| | Control Group | | | Experimental Group | | |
|---|---|---|---|---|---|---|
| | (1) C-F | (2) C-W | (3) C-Total | (4) E-F | (5) E-W | (6) E-Total |
| $\bar{X}$ | 33.4 | 23.5 | 29.02 | 34.4 | 29.6 | 33.08 |
| N= | 25 | 20 | 45 | 18 | 7 | 25 |
| S.D. | 6.708 | 7.12 | 8.45 | 8.41 | 5.80 | 5.87 |
| Comp 1 | - | * | - | - | - | - |
| Comp 2 | * | - | - | - | - | - |
| Comp 3 | - | - | - | - | - | t(68)=2.13 P = 0.035* |
| Comp 4 | - | - | - | - | NS | - |
| Comp 5 | - | - | - | NS | - | - |
| Comp 6 | - | - | t(68)=2.13 P = 0.035* | - | - | - |
| Drop Rate | - | - | 44% | - | - | 28% |

TABLE 3

Summary of Between and Within Group Comparisons for Exams 1,2,3,4

Means (X), sample size (N), standard deviation of the mean (S.D.) are given for each group or subgroup. Group and subgroup designations are as follows: (C) Control; (E) Experimental; (E-W) Essay Writers in Experimental Group; (E-NW) Non-essay writers in Experimental group (O-1); (*) significant at P> 0.95; (NS) not significant; (MC) multiple choice; (EN) = Exam N, where N = 1, 2, 3, 4.

| Treatment | E1 | E2 | E3 | E4 |
|---|---|---|---|---|
| 1) Comparison of C and E groups who took E2, E3, E4 using E1 multiple choice scores | * | NS | NS | NS |
| 2) Comparison of C and E group multiple choice scores on E(N) | - | NS | NS | * |
| 3) Comparison of Essay Writers (E-W) or E(N) with Non-writers (E-NW) or E(N) using MC scores from E(1) | - | NS | NS | NS |
| 4) Comparison of Essay Writers (E) with Total Non-Essay writers (C+E-NW) using E(N)- MC scores | - | * | * | NS |

TABLE 4

Between group comparisons using Exam 2 multiple choice scores for the total Control (C) group, total Experimental (E) group, essay writing subgroup of the Experimental (E) group (EW), non-essay writing subgroup of the Experimental (EN) group, and the pooled non-writers from the Control and Experimental groups (C+E-N). Numbers preceding each group are subgroup numbers for statistical comparison. (*) statistically significant at P> 0.95; (NS) not significant.

| | C | E | EW | EN | C+EN |
|---|---|---|---|---|---|
| $\bar{X}$ | 28.8 | 30.5 | 32.7 | 28.6 | 28.7 |
| N | 32 | 22 | 10 | 12 | 44 |
| S.D. | 7.90 | 7.40 | 7.59 | 7.00 | 7.51 |
| t-test w/: | | | | | |
| C | - | NS | - | - | - |
| E | NS | - | - | - | - |
| EW | - | - | - | NS | NS |
| EN | - | - | NS | - | - |
| C+EN | - | - | - | | - |

TABLE 5

Results of t-tests for independent groups using Exam 3 multiple choice scores for the total Control (C) group, total Experimental (E) group, essay writers in the Experimental (EW) group, non-essay writers in the Experimental (EN) group, and the pooled group of non-essay writers from the Control and Experimental groups (C+EN). (*) significant at P> 0.95; (NS) not significant.

| | C | E | EW | EN | C+EN |
|---|---|---|---|---|---|
| X | 30.5 | 30.2 | 35.5 | 25.5 | 29.3 |
| N | 27 | 19 | 8 | 11 | 38 |
| S.D. | 7.08 | 7.61 | 5.8 | 5.9 | 7.1 |
| t-test/w: | | | | | |
| C | - | NS | - | - | - |
| E | NS | - | - | - | - |
| EW | - | - | - | * | * |
| EN | - | - | * | - | - |
| C+EN | - | - | * | - | - |

TABLE 6

Results of t-tests for independent groups using multiple choice scores for C, E, EW, EN, and C+EN. Letter designations as in Table 3. (*) significant at P> 0.95; (NS) not significant.

| | C | E | EW | EN | C+EN |
|---|---|---|---|---|---|
| $\bar{X}$ | 26.1 | 22.2 | 20.8 | 24.0 | |
| N | 26 | 19 | 8 | 11 | |
| S.D. | 4.74 | 7.07 | 4.66 | 9.70 | |
| t-test w/: | | | | | |
| C | - | * | | | |
| E | * | - | | | |
| EW | | | - | NS | |
| EN | | | NS | - | |
| C+EN | | | | | |

FIGURE 1

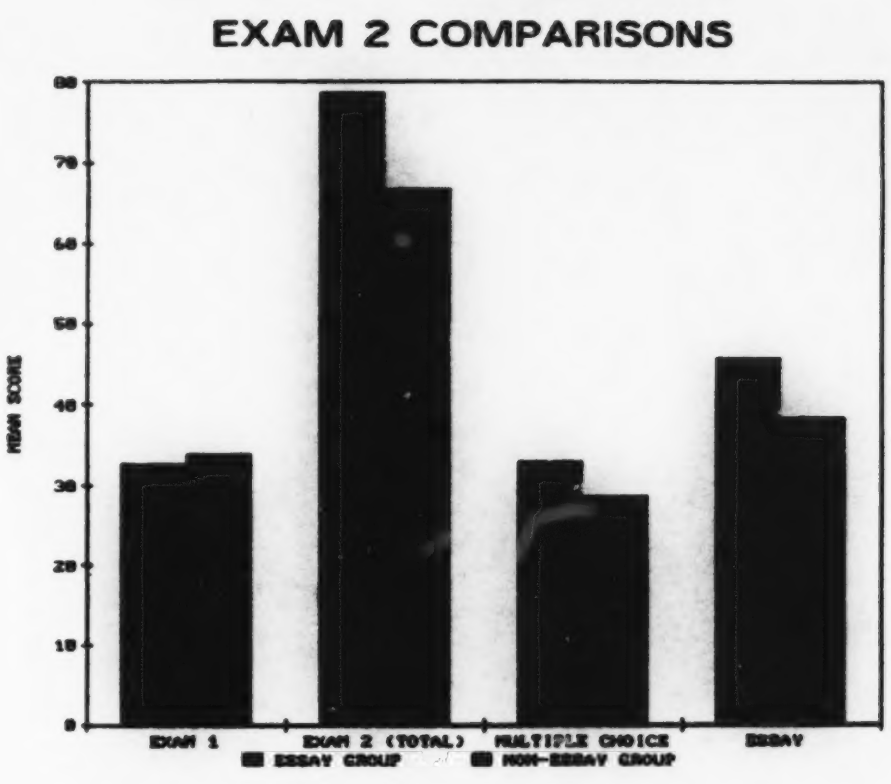
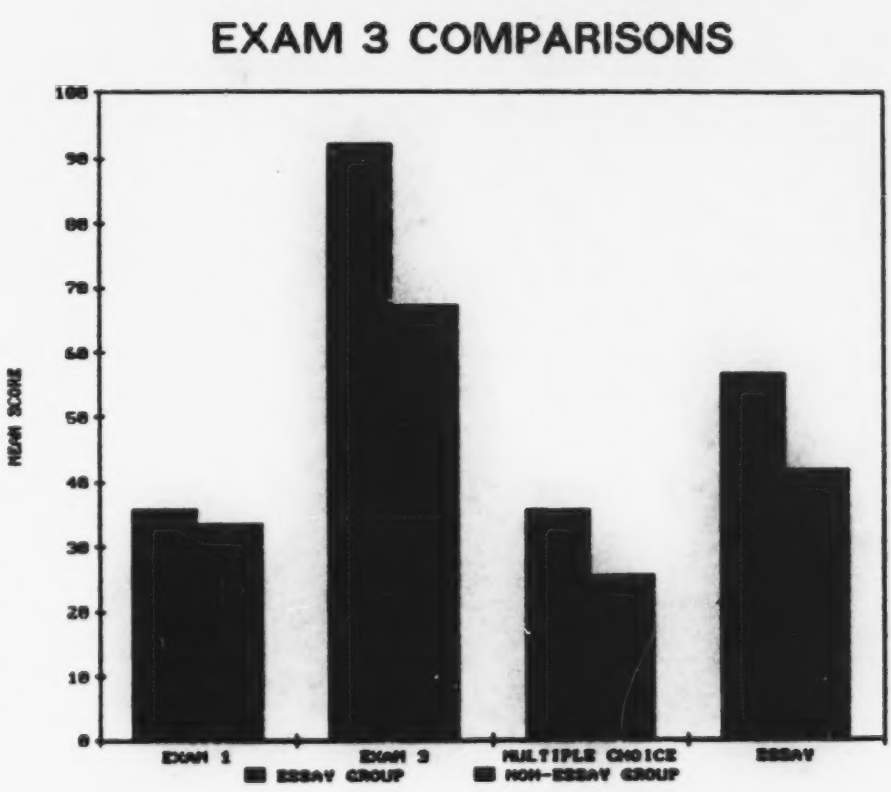

EXAM 2 COMPARISONS
MEAN SCORE
80
70
60
50
40
30
20
10
0
EXAM 1
EXAM 2 (TOTAL)
MULTIPLE CHOICE
ESSAY
ESSAY GROUP
NON-ESSAY GROUP

FIGURE 2


EXAM 3 COMPARISONS
MEAN SCORE
100
90
80
70
60
50
40
30
20
10
0
EXAM 1
EXAM 3
MULTIPLE CHOICE
ESSAY
ESSAY GROUP
NON-ESSAY GROUP

# "IS WRITING AN EFFECTIVE WAY TO LEARN CHEMICAL CONCEPTS?"

A RESEARCH PROJECT CONDUCTED BY
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SPRING SEMESTER 1989

## OVERVIEW

We, educators, want our students to "learn" chemistry but most of us want the students to be able to do more than recognize or recall information. We would like the students to have the ability to (1) integrate concepts, (2) apply the integrated concepts, particularly to real-life situations, and (3) communicate those concepts. However, in spite of our wishes, students tend to learn what is necessary to complete the homework and pass the course exams. If the exams and homework require only recognition or recall of information, that is what most students will learn. If we want students to be able to integrate and apply concepts and to communicate those concepts, we must give them practice in those skills, and we must test them on those skills.

Several years ago I started giving exam questions which required an integration and application of chemistry concepts, and communication of those concepts. I quickly found that the students could not perform well on that type of an examination. My findings agreed with the conclusions given in a symposium sponsored by the Division of Chemical Education of the American Chemical Society[1] that chemistry graduates can make calculations but they cannot explain the purpose for, or significance of, those calculations. Realizing that students must be taught how to integrate and apply concepts, as well as how to communicate their knowledge, I devised "critical-thinking writing assignments" to give the students homework practice.

Even though these assignments require much more thought and effort than the traditional end-of-chapter exercises student response has generally been favorable. The students like best the practical-application aspect of the assignments. They like knowing that there is some real use for the results of their arduous calculations. They also think that this type of assignment will teach them skills that will be useful in other classes and in real life.

However, I have found some drawbacks to the writing assignments. One, the time spent on completing the writing assignments limits the time the students have for the traditional drill-type exercises. (Which means that they might not perform as well on standardized, multiple choice exams.) Two, most students for whom English is a second language do very poorly on the writing assignments. (And the ESL students who have performed well in prior science and math courses feel that it is totally unfair to require communication skills in a science course.) Third, the writing assignments require considerable instructor time to evaluate.

After requiring writing assignments for several semesters, I wondered if they were really worth the time and effort--on the part of both students and instructors--which they required.

## METHODOLOGY

### Project design

This study has attempted to determine if critical-thinking writing assignments are more effective than traditional end-of-chapter exercises in promoting a higher level understanding of chemical concepts by students in the second semester (Chemistry 1B) of a traditional two-semester general chemistry course. A comprehensive midterm exam, which required application of many concepts to a real-world problem, was chosen as the primary measuring instrument. An attitude survey was selected as a secondary measuring instrument. All students were given the same lectures and performed the same laboratory experiments. In addition, for an eight-week study of the chemistry topics of equilibrium, ionic equilibrium, electrochemistry and thermodynamics, the class was divided into two groups on the basis of laboratory enrollment. After the eight week period, both groups of students were given the same assignments, which included both drill exercises and writing assignments.

During the project period, the control group, (A), was assigned weekly end-of-chapter exercises, while the experimental group, (B), was given critical-thinking writing assignments. For example, on the subject of chemical equilibrium, one of the control group questions was:

> "The equilibrium constant, Kc, for the reaction $PCl_5(g) = PCl_3(g) + Cl_2(g)$ is 0.0211 at 150°C. Calculate the equilibrium constants of $PCl_5$, $PCl_3$ and $Cl_2$ starting with a concentration of $PCl_5$ of 1.0M.

An experimental group question on the same subject was:

> One cause of acid rain is the reaction $SO_3(g) + H_2O(l) = H_2SO_4$. The $SO_3$ is produced by the oxidation of $SO_2$, which is a common by-product of the manufacture of many metals as well as the burning of sulfur-containing fuels. One method for utilizing the waste $SO_2$ is to oxidize it to $SO_3$ and then pass the gas through powdered, solid CaO, according to the reaction $SO_3(g) + CaO(s) = CaSO_4(s)$. The $CaSO_4$ is sold for fertilizer. Assume, for this problem that you are a chemist working for Acme Mines and Minerals Company.
>
> (A) Calculate the maximum number of moles of $CaSO_4$ that can be produced (in a closed container) from 0.25 mol/L $SO_3$ and excess CaO at 125°C. Kc = 8.2.
>
> (B) Explain why 0.25 mol of $SO_3$ and excess CaO will not produce 0.25 mol of $CaSO_4$ at 125°C.
>
> (C) Write a letter to your plant supervisor in which you (1) explain the calculations of (B), (2) state what conditions you would change in order to produce a greater amount of $CaSO_4$, and (3) explain why you think your suggested conditions would produce a greater yield.

Group B students were given detailed instructions on how to complete their homework assignments. These instructions are found in Appendix 1. The instructor discussed the homework with each respective group after the homework was turned in and before the weekly quiz was given. Appendix 2 gives an example of a group (B) quiz. Only a portion of each homework assignment was graded. The characteristics of the weekly homework and quizzes for each group are shown in Table 1.

Table 1. Characteristics of Assignments for Control Group (A) and Experimental Group (B).

| | Control | Experimental |
|---|---|---|
| Homework frequency | Weekly | Weekly |
| # questions/homework | 20-25 | 2-4 |
| Type problems | Single concept short answer or calculations | Multiple concept calculations, written explanations. |
| *Time required to complete homework | 4-5 hrs. | 10-12 hrs. |
| Quiz frequency | Weekly | Weekly |
| Type quiz | Single concept, multiple choice | Multiple concept, similar to homework |
| # questions/quiz | 5 | 1-2 |
| Time allowed for quiz | 1 hr. | 1 hr. |

*The average time reported by the students.

Although it was not possible to ensure that the control and experimental groups had equal ability, the initial average chemistry 1A grade (the single parameter which we have found predicts best a student's success in chem 1B) was comparable for both groups at the beginning of the semester. A prequiz containing chemistry 1A questions, given the first day of lab, measured mostly the recency of the student's chemistry 1A course. Table 2. gives the characteristics of the control (A) and experimental (B) group.

Table 2. Characteristics of Students in Research Project

| | Control | Experimental |
|---|---|---|
| # students at the start | 24 | 29 |
| Ave grade in Chem 1A | 2.58 | 2.52 |
| # students at 8th week | 18 | 24 |
| Ave grade in Chem 1A | 2.56 | 2.79 |

After the first week, two of the students from the experimental group were moved to the control group because their ability with the English language was not good enough to enable them to understand the quiz and homework questions. (One non-native student could not understand the experimental group homework or quiz questions at all. Yet this girl could work drill-type problems well enough to receive a "B" in chemistry 1A and also a 75% on the pretest.) Eight students from the control group, including four of six "B" students, and three students from the experimental group, dropped the class before the midterm exam. The drops resulted in a higher average chemistry 1A grade for the group (B) than for the group (A).

During the last quiz period, students in both groups completed an attitude survey, and then made comments about their homework and quizzes. Figure 1 shows the survey instrument.

At the end of 8 weeks, all students were given a 3-hour open-book examination with questions over material unfamiliar to both groups. The exam consisted of a step-by-step description of two industrial methods for producing elemental cobalt, followed by questions about the methods. The exam questions are shown in Appendix 4.

Since there were some essay questions on the exam, student papers were marked with code numbers at the time they were turned in to prevent the instructor from identifying the author of any exam paper. To increase uniformity in grading, every question #1 was graded and then every question #2, etc.

After the exams were given, the students were allowed to look at their papers, but not take the papers. A 1-1/2 hr makeup midterm exam was given two days after the students were informed about their performance on the first midterm. The makeup exam was optional; the students were advised to take it only if they felt that a stress situation had prevented them from doing well on the first exam. Eighty three percent of the control group and seventy-five percent of the experimental group took the makeup exam.

The makeup exam, which was similar in format to the midterm exam, consisted of a description of two methods for the industrial preparation of chromium metal. Appendix 5 gives the questions asked on this exam.

FINDINGS

Results

The students in the control group were very comfortable with their homework assignments. During the discussion period the instructor went over any problem with which a student had difficulty. The answers to all questions and problems were posted a few days before the quiz was given.

The students in the experimental group were extremely frustrated at the beginning of the project. Although the students were given detailed samples, and instructions for the writing assignments, their performance on the first homework assignment and quiz was not satisfactory. However, each week the students were given repeated instructions about selecting the pertinent concepts, using those concepts to make calculations, and then explaining the results of their calculations in a logical manner. Each week, the best homework papers were posted for the other students to read. Each week the student's performance improved.

The midterm exam was a disaster for many of the students. Although all of them had performed similar calculations in their homework and quizzes, some of the students spent much of the exam time trying to decide what to do. Since most students had midterm scores much lower than their quiz scores, a repeat midterm was given in an attempt to find a more valid instrument to measure the achievement of students who had been "stressed-out" on the first midterm. Almost all students obtained better scores on the second exam.

A statistical analysis[3] was performed by Gene Sellers to determine if the scores on the homework, quizzes and midterms were significantly different between the two groups. The statistical method is given next and the results are given in Table 3. (Because of the sample size being less than 30 the assumption was made that the distributions of scores were at least approximately bell-shaped.)

## Statistical Method

The null hypothesis is that the scores on the homework, quizzes and exams are not significantly different for the two groups.

$H_o$: $\mu_1 - \mu_2 = 0$
$H_a$: $\mu_1 - \mu_2 > 0$

$\mu_1$ is the mean of (B)
$\mu_2$ is the mean of (A)

The test statistic is:

$$T = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$\bar{x}$ = mean of (B) $\bar{y}$ = mean of (A)
$s_1$ = std. dev. of (B)
$s_2$ = std. dev. of (A)
$n_1 = 24$, $n_2 = 18$

At the 5% level ($\alpha = 0.05$), if $T > 1.65$, then reject $H_o$

---

Table 3. Comparison of Homework, Quiz and Midterm Scores Received by Control Group and Experimental Group Students. Results given in the form (mean/standard deviation).

| Work Type | Control | Experimental | T |
|---|---|---|---|
| n | 18 | 24 | |
| Homework | (89.6/10.9) | (86.1/10.2) | -1.05 |
| Quiz | (57.5/21.0) | (68.7/13.5) | 1.98 |
| Midterm I | (29.9/17.4) | (48.9/23.9) | 2.99 |
| n | 15 | 18 | |
| Midterm II | (41.8/24.2) | (64.6/17.2) | 3.06 |

Statistical Conclusions:
1. No significant difference in homework scores
2. Significant difference in both quiz and midterm scores.

---

Because the average chemistry 1A grades of students in the experimental group was higher than that of the control group at the end of the project, an analysis was made of midterm exam grades for "A", "B" and "C" students from each group. Table 4 shows the results:

Table 4. Midterm and Make-up Midterm Scores of Individual Students Listed According to Grade Received in Chem 1A.

Control Group

| "A" in Chem 1A | | "B" in Chem 1A | | "C" in Chem 1A | |
|---|---|---|---|---|---|
| Midterm | Makeup | Midterm | Makeup | Midterm | Makeup |
| 33 | 82 | 29 | 34 | 6 | -- |
| 48 | 64 | 57 | 70 | 11 | 13 |
| 55 | 74 | | | 13 | 19 |
| 68 | 74 | | | 16 | 28 |
| | | | | 16 | 34 |
| | | | | 19 | -- |
| | | | | 19 | 25 |
| | | | | 21 | 30 |
| | | | | 25 | 15 |
| | | | | 30 | 44 |
| | | | | 36 | 21 |
| | | | | 36 | -- |

| | "A" Students | | "B" Students | | "C" Students | |
|---|---|---|---|---|---|---|
| | Midterm | Makeup | Midterm | Makeup | Midterm | Makeup |
| Mean | 51.0 | 73.5 | 43.0 | 52.0 | 20.7 | 25.4 |
| S.D. | 14.6 | 7.4 | 19.8 | 25.5 | 9.5 | 9.8 |

Experimental Group

| "A" in Chem 1A | | "B" in Chem 1A | | "C" in Chem 1A | |
|---|---|---|---|---|---|
| Midterm | Makeup | Midterm | Makeup | Midterm | Makeup |
| 21 | 98 | 10 | 48 | 21 | 28 |
| 70 | -- | 20 | 47 | 23 | 54 |
| 70 | 90 | 51 | 62 | 23 | 62 |
| 77 | 90 | 51 | 67 | 26 | 58 |
| 90 | -- | 61 | -- | 32 | 65 |
| 91 | -- | 62 | 81 | 32 | 62 |
| | | 67 | 67 | 34 | 54 |
| | | | | 52 | 55 |
| | | | | 55 | 64 |
| | | | | 62 | -- |
| | | | | 74 | -- |

| | "A" Students | | "B" Students | | "C" Students | |
|---|---|---|---|---|---|---|
| | Midterm | Makeup | Midterm | Makeup | Midterm | Makeup |
| Mean | 69.8 | 92.7 | 46.0 | 62.0 | 39.5 | 55.8 |
| S.D. | 25.2 | 4.6 | 22.2 | 12.9 | 18.2 | 11.2 |
| t Value: | 1.49 | 5.62 | 0.18 | 0.53 | 3.06 | 6.13 |

Statistical Conclusions:

1. No significant difference on first midterm between groups for A" and "B" students.
2. Significant difference on makeup midterm for "A" students, but not for "B" students.
3. Very significant difference between groups for "C" students.

A statistical analysis of the attitude-survey instrument is given in Figure 1, shown below:

Figure 1. Attitude Survey: Evaluation of Homework and Quizzes

| | (Mean score/S.D.) Control | Exptl |
|---|---|---|
| 1. The amount of work required for the homework was about right for a 5-unit science class. . . . | (3.00/0.73) | (2.92/0.50) |
| | t = -0.38 | |
| 2. The score I got on the quizzes was directly proportional to the amount of effort I put in on the homework. . . . . | (2.81/1.05) | (2.52/0.83) |
| | t = -0.93 | |
| 3. I found the homework questions challenging. . . . | (3.33/0.62) | (3.75/0.44) |
| | t = 2.34 | |
| 4. I found it helpful to work with other students on the homework. . . . . | (3.19/0.91) | (3.29/0.69) |
| | t = 0.37 | |
| 5. My quiz scores were an accurate measurement of my knowledge and ability . . . . . | (2.63/0.81) | (2.69/0.69) |
| | t = 0.24 | |
| 6. The homework questions required a very good understanding of the chemical concepts. . . . . | (2.88/0.34) | (3.67/0.88) |
| | t = 6.09 | |
| 7. After completing the homework, I felt I understood the chemical concepts. . . . . | (3.13/0.50) | (2.88/0.73) |
| | t = -1.28 | |
| 8. I feel that by doing the homework I am learning knowledge and skills that will help me in future chemistry courses in college.. . . . . | (3.25/0.58) | (3.29/0.61) |
| | t = 0.21 | |
| 9. I feel that by doing the homework, I am learning knowledge and skills that will help me in future courses, other than chemistry, and will also help me in my career.. . . . . | (3.25/0.45) | (3.33/0.56) |
| | t = 0.50 | |
| 10. I would recommend this type of homework for future chem 1B students. . . . . | (3.03/0.59) | (3.02/0.60) |
| | t = 0.05 | |

The comments made by the students on the survey instrument are given in Appendix 5. These comments indicated that most students in both groups were satisfied with their homework. One student in the experimental group did not like the kind of homework and quizzes and felt the type made the class more difficult than normal. But a student in the control group complained, "Group B, even if they didn't perform as well on the quizzes, have gotten a better understanding of the concepts behind the work. It's easy to memorize an equation and kick out numbers, but a more thorough understanding of the work makes life a lot simpler in the long run, especially in other courses."

One astute student in the control group commented: "The homework/quiz scheme was very educational and extremely inspirational. The fact that you will be quizzed on at least 5 parts of the homework each week should be enough inspiration for anybody to do all of the homework."

Many students in the control group complained that they did not like multiple choice quizzes because there was no part credit given.

Almost all of the students in the experimental group commented that they liked the real-life aspect of the questions, that the homework was a lot more interesting than traditional homework, and that they felt this type of homework/quizzes would be of value to them in their careers. One student commented: "What I liked about the homework and quizzes was that it wasn't just a lot of calculations and busy, tedious work to get an answer. We had to know why we used the formulas and how it applied, which gives one a much better understanding of things, rather than plugging numbers into formulas."

Discussion

There were some surprises from this study. One was the scarcity of complaints from the experimental group students. Since both control and experimental group students attended the same lectures, the experimental group students were well aware that the control group students had a much easier Chem 1B life. However, very few complaints were received from the experimental group students about the unfairness of the situation. In fact, several students commented that they knew they had to work much harder, but they felt they were learning more and so they wanted to continue the experiment.

One event that occurred after the midterm exam was given, came as a total surprise to the instructor. Even though (after the exam) all students were assured that the midterm score would not count on their grade, several of the good students in the control group complained that they felt that they didn't get to learn as much as the students in the experimental group.

The author is very skeptical of the validity of quantitative attitude-survey instruments; the inconsistencies in the results of this instrument confirmed that skepticism. Some of the inconsistencies are the following:

One, during the course of the project many students in the experimental group were excited that they were learning skills that would be valuable in their future academic and career lives, but not one student in the control group made such comments. Several experimental group students made written comments about the usefulness of their homework, only one control group student made such a comment. Yet, there were no significant differences between the two groups on the responses to question 9 and 10. These results could be interpreted to mean than students who have never encountered anything except drill-type homework think if an instructor assigns homework, it must be important for later courses.

Another inconsistency was that the author received complaints from nearly every student in the experimental group that the homework required too much time, but no such complaints from the control group. Yet, on question 1, most students from both groups responded that they thought the amount of work was about right for a 5-unit science class. One interpretation of this result is that students will give the response that they think the instructor wants.

A third inconsistency was that significantly greater number of experimental group students thought their homework required a very good understanding of chemical concepts (question 6), but lightly more of the control group students felt that they understood the chemical concepts after completing the homework (question 7). This result was obtained even though most control-group student knew they had performed poorly on their quizzes. Perhaps the experimental group students were more realistic about their learning, or perhaps the control group were giving the reponses they thought they should give.

The difference between the homework and quiz scores of the students in the two groups was surprising to the instructor. Since the control group homework was much easier than that of the experimental group, and the quiz questions were almost identical to the homework questions, it was expected that the control group quiz scores would be much higher than that of the experimental group. Instead the experimental group quiz scores were significantly higher.

A possible conclusion, with implications for chemistry instructors, is that very little information is actually learned from working drill exercises with an open book. Conversely, if a student puts forth the mental effort to integrate concepts to make calculations and then explain the significance of those calculations, real learning does take place. This conclusion was supported four weeks later when students from the experimental group performed better on a comprehensive "objective" exam than did students from the control group.

The instructor expected a better performance from the experimental-group students on the first midterm exam. But many of these students mentioned that they had never encountered similar homework quizzes or exams; it is probably too much to expect them to learn in eight weeks how to cope with multiconcept application-type questions which also require communication skills. The author feels tht the midterm exam would have been a better instrument if it could have been a take-home exam, because all of the students were pressed for time and many students gave up when they found that they didn't know what to do with the questions. The differences between groups might also have been greater if the experiment had continued for the entire semester, so the experimental group could have had more training in selecting and applying pertinent concepts. The author did not continue the experiment for the entire semester because she wanted a "catch-up" period in which all students would be performing the same task.

Even though the scores on the midterm exam were not as good as the instructor would have liked, the differences between the control and experimental group were significant to almost three standard deviations. This result indicates that students can be taught to apply concepts to real-life problems and to understand and explain the significance of the results of their calculations.

A comparison of the first midterm exam scores for "A", "B" and "C" students indicated the following: (1) that the difference between the scores of the "A" students at the 5% confidence level was not significant on the first midterm, (however, it would be if the score of the student who "bombed-out" was not included in the test) but it was significant on the makeup exam, (2) there were too few "B" students in the control group to make a comparison and (3) the "C" students in the experimental group performed significantly better on both exams than did the "C" students in the control group. This last result leads to perhaps the most significant conclusion from this study i.e. ordinary average students can be taught higher orders of learning skills.

The author would have liked to have a larger sample of students, but the sample included all students who were taking Chemistry 1B at the college during the semester that the study was made.

SUMMARY

The performance of the experimental group indicated that the completion of frequent critical-thinking writing assignments is a more effective way to learn chemical concepts than traditional drill-type exercises.

Recommendations

Both the instructor and students recommend that critical-thinking writing assignments be continued. But both instructor and students think that a homework assignment and quiz each week is too much. And both instructor and students think that drill-type homework, quizzes and exams should be included along with the writing-assignments.

The instructor would like to see this study extended to a larger sample of students. Perhaps students from several different colleges could be included in the study.

References:
[1]Chemical Engineering News 1985, 63(38)32
[2]VanOrden, Naola, "Critical-Thinking Writing Assignments in General Chemistry, J. Chem. Educ. 1987, 64 (6) 506-7
[3]Sellers, Gene and Vardeman, Steven, "Elementary Statistics, Saunders College Publishing, Phila. PA, 2nd Ed. 1983 p 344-348.

Appendix 1. Homework (B) Instructions & Samples. Spring 1989

Grading Criteria:
3 pts -- all necessary concepts mentioned
3 pts -- chemistry (calculations, equations, etc.) correct
3 pts -- writing developed in a logical, understandable manner
1 pt -- writing grammatically correct.

Sample Problem 2

A customer has on her property a pond in which the fish are dying from acid rain. The lake now has a pH of 5.7.

A) Explain what could be done to the pond to make it habitable for fish.
B) Explain why you would expect the treatment to be effective.
C) Calculate the amounts of two buffer components, per liter of pond water, needed to make a 0.05M buffer of pH = 6.8, that would be suitable for the lake.
D) Write a letter to your customer explaining what she should do to the lake in order to make it habitable for the fish.

Sample Answer:

Concepts needed to answer question
1. To prevent pH change, use a good buffer
2. Select buffer system in which pKa +- desired pH = or - 1 unit
3. For a buffer, $[H^+][A^-]/[HA] = Ka$ and $pH = pKa + \log([A^-]/[HA])$
4. Total mmol = mL x M buffer; Total mmol = mmol ($A^-$) + mmol (HA)

A) Since the pond is too acidic, a base must be added to neutralize the acid. The least expensive base is probably lime, CaO.

$$CaO + 2H^+ \rightarrow Ca^{++} + H_2O$$

After the acid has been neutralized, it will be necessary to buffer the pond at the desired pH. Since the buffer itself must not be toxic to the fish, a $CO_2/HCO_3^-$ or a $H_2PO_4^-/HPO_4^=$ buffer would be good choices. The $CO_2$ buffer is less stable than the phosphate buffer because the solubility of $CO_2$ changes too much with temperature. Assuming the customer can afford the phosphate buffer components, I will select that buffer.

B) If the concentration of the buffer is considerably higher than the concentration of any acid or base that might get into the pond, the buffer will keep the pH constant by the process given below:
If acid rain falls into the lake, the $HPO_4^-$ will react with the $H^+$ to form $H_2PO_4^-$:

$$HPO_4^- + H^+ \rightarrow H_2PO_4^-$$

a small amount of the buffer $HPO_4^-$ will be used up and a small amount of $H_2PO_4^-$ will be formed, but their ratio will remain almost the same and hence the pH will remain almost constant:

$$pH = pKa + \log[HPO_4^-]/[H_2PO_4^-]$$

C) (1) To calculate the amounts of buffer components, I must first find the Ka for the dihydrogen phosphate buffer.

$$[H^+][HPO_4^-]/[H_2PO_4^-] = 6.2E-8$$

(2) Next calculate the conj.base/conj.acid ratio;
$H^+ = \text{invlog } -6.8 = 1.6E-7$
$[HPO_4^-]/[H_2PO_4^-] = 6.2E-8/1.6E-7 = 0.38$

(3) The total mmol buffer components is equal to the sum of each component.
mmol $HPO_4^-$ + mmol $H_2PO_4^-$ = 1000 mL x 0.05M = 50 mmol
Let $[H_2PO_4^-] = y$, $[HPO_4^-] = x$
$x/y = 0.38$, $x + y = 50$
$0.38y + y = 50$
$y = 36.2$mmol, $x = 13.8$mmol

(4) To prepare the buffer, I will mix 36.2mmol $H_2PO_4^-$ with 13.8 mmol $HPO_4^-$

(5) To calculate the mg of each, multiply the mmol by the molecular weight of each component. (Suppose I have available the monohydrate of $NaH_2PO_4$ and the dihydrate of $Na_2HPO_4$)
13.8 mmol $NaH_2PO_4$ x 137.99 mg
$NaH_2PO_4.H_2O$/mmol = 1900mg
36.2 mmol $Na_2HPO_4$ x 177.99 mg
$Na_2HPO_4.2H_2O$/mmol = 6443 mg

(6) To prepare the buffer I will add 6.44g $NaH_2PO_4.H_2O$ + 1.90g $Na_2HPO_4.2H_2O$ to each liter of water.

D) Letter to Customer:
Dear Ms. Hill:

I have listed below the procedures that I will follow to correct the acidity of your fish pond.

1. Since your pond is now acid, I will add enough lime to neutralize the acid. I will check the pH with a meter.

2. Because acid rain is an ever-present problem in your area, I will add a buffer to keep the acidity of the pond constant at a pH that is right for your fish. I have prepared this buffer in my laboratory. The buffer is very good for fish, but unfortunately it is also good for algae; therefore I have also added a small amount of a substance which inhibits algae growth.

3. The buffer will last approximately one month. I will continue to test the pond and add more of the buffer (if necessary) each month for the year of our contract.

I am enclosing a statement of costs for the first month. The cost thereafter will depend upon the amounts of buffer used; this cost it will not be greater than that of the first month.

Sincerely,
Kathy Mason, Manager

Appendix 2. Sample of an Experimental-Group Quiz

Chem 1B Group (B) Quiz, Ch. 7

Write a memo to a colleague explaining the following:

Whether or not, NO is a possible atmospheric oxidant of $SO_2$
A. if standard conditions prevail.
B. assuming the following initial conditions: temp = 200K, $pSO_2$ = 0.01atm, pNO = 0.001 atm,
p $N_2$ = 0.5 atm, p $SO_3$ = 1E-5 atm.

$$NO + SO_2 - SO_3 + 1/2N_2$$

Appendix 3. Midterm Exam Questions

1. Draw flowcharts for each separation method.
2. Step (1a). Explain why Co and Fe dissolve in sulfuric acid, but Cu does not. (Assume standard conditions) Justify with equations and calculations.
3. Step '1b). Calculate the pH of the solution after $Na_2CO_3$ is added.
4. Step (1c). Explain why is it necessary to add an oxidizing agent to the cation mixture before separating the ions by hydroxide precipitation? Justify with equations and calculations.
5. Step (1c). Explain why the solution was made basic before the oxidizing agent was added. Justify with equations and calculations. (Assume standard conditions.)
6. Step (1d). What buffer would be good for separation of the two hydroxides? Justify with equations and calculations.
7. Step (2b). What must be the initial voltage range to reduce the copper, but not the cobalt, assuming standard conditions?
8. Steps (1f and 2d). Compare the energy (work) in kJ/mol of reactant, required for the final reduction step of each method 1, using the given conditions.
9. On the basis of the information given in the question, and the results of your calculations, explain which is the most economical method for producing cobalt? Give reasons for your answer.

Appendix 4. Makeup Midterm Questions

1. Write the balanced net ionic equations for steps 1,2,5 of the methods.
2. Explain (with calculations) why the mixture of step 1 is oxidized before filtering off the $Fe(OH)_3$.
3. Compare (quantitatively) the electrical energy in kJ necessary to produce one mole of Cr by method A with that needed to produce one mole of Cr by method B. (State any assumptions in your calculations.)
4. Considering the big difference in energy required, explain two reasons why chromium is sometimes produced by method B.

Appendix 5. Student Comments to Evaluation of Homework and Quizzes

Group (A) End-of-chapter problems, multiple choice quizzes.

1. By doing homework and quizzes, I feel I have a better grasp on class material, for the material has been reinforced. This, in turn, will help in the future, not only with other science classes, but also in a career, for I will be better able to apply myself.

2. The quizzes were O.K. if you just wanted the answer, but they didn't give credit for at least knowing part of how to get the answer. The homework was great--it gave a good coverage of what was needed to do other problems and will help in future; but the quizzes were all but useless.

3. The homework problems were challenging, but not at the point where I was not able to solve it. The quizzes were kept short which gave me enough time to carefully read through the questions before answering them.

4. The homework was too short. We should have been required to complete all the problems, instead of only just 5 questions. Higher quiz scores would be the result if we had to complete all the problems.

5. The homework was challenging, and the problems require patience and understanding of the material. I like taking quizzes because it show how well I can work the problems or what i should work on to improve myself.

6. I can do all homework but somehow when I did the quiz, I can't find the answer that I had found on that homework.

7. (no written comments)

8. The quizzes should not be multiple choice because a slight mistake in the calculations will count the whole problem against the student. The homework material should be covered more thoroughly in the lectures and there should be more time to do the homework after the subject completed in the lecture.

9. What I liked about the homework is that it prepared me for the quiz. What I didn't like were some of the question on the quiz were part of the homework.

10. There was not enough time after the lecture before the homework was due.

11. I know that the extent to which I understand is governed by the time and effort I put into studying, but I feel that group B, even if they didn't perform as well on the quizzes, have gotten a better understanding of the concepts behind the work. It's easy to memorize an equation and kick out numbers, but a more thorough understanding of the work makes life a lot simpler in the long run, especially in other courses.

12. Multiple choice quizzes give you an answer to shoot for. If your(sig) wrong on the quiz you know right away and you can keep trying. On the other hand receiving partial credit for what you have done is realy(sig) nice also and it shows that you have an understanding of the concepts.
The amount of homework for this course was the right amount. I found the homework, for the most part, very difficult and I encourage the use of study groups.

13. The homework/quiz scheme was very education and extremely inspirational. The fact that you will be quizzed on at least 5 parts of the homework each week should be enough inspiration for anybody to do all of the homework. I've also enjoyed the practical applications that we have discussed in class as well; these insights really help me to see the real, practical value of chemistry in my future career. Homework all being in one place is also very nice, handy, calming. I think it's really nice to know exactly what the instructor wants you to know, instead of being told to do all of the odd problems in the back of the book. The lecture supplements are also an invaluable source of condensed knowledge which explain concepts in clear, concise terms.
I know that I have worked harder on this chemistry homework than any before, and I now can spout chemical concepts in conversation to explain natural phenomena and then give a basic explanation of what I meant (how exciting)!

14. I thought the homework and quizzes were fair. I admit I wouldn't be doing so well with type (B) homework and quizzes.

15. The homework made student study chemistry almost most of time so that student enjoy chemistry and let him explain his knowledge about chemistry because I believe almost every thing in this world relate to chemistry.

16. The homework wasn't really hard, but when the quizzes came, the quizzes seemed more difficult.

17. (no written comments)

Group B. Real-life Homework and quizzes; Written communication required.

1. Never having had a course with questions and homework like these made it a little tough in the beginning. Maybe there is a way to use both types of quizzes in the early stage of this course and then gradually change it to all essay questions. I feel that this type of homework requires one to know thoroughly all concepts that are required. This is good. Conversely, though, if one cannot express the concepts in a verbal manner it will be a penalty. This is bad.

2. What I liked about the homework and quizzes was that it wasn't just a lot of calculations and busy, tedious work to get an answer. We had to know why we used the formulas and how it applied, which gives one a much better understanding of things, rather than plugging numbers to formulas. Although it was hard for me in some cases to get started on what to do first, once I knew what to do, the ball would roll.

   Of course, I feel in the future that this type of homework enables me to practice expressing myself on paper, which is valuable in all aspects of work. Communication is very important.

3. I felt the homework was very challenging and one certainly had to understand the concepts to get a good grade on the quizzes. However, I felt that the material was covered to quickly to be able to understand what you're doing.

   This class requires much more work than I have ever put into a class and I've learned a lot, but I would have liked to have know ahead of time (or forewarned!) just how much time it would take.

4. I found that when I put too much time into the written homework I began doing worse on tests. With a limit of available time, I am doing better now by splitting about 30% review, 30% on optional homework problems and 40% on written homework.

5. I liked the homework. It did bring out a sense/feel of practicality and how concepts could be associated to the real world. The pollution questions really sparked interest with me. I think it is important to know the steps/concepts to ones goals/problem. I do believe that there's much value in writing down concepts. It seems reasonable, logical and its a good study/learning tool.

6. I didn't care for the format of the homework, or the quizzes, and I feel that this makes the class more difficult than normal.

7. I thought that the unusual format of the homework and quizzes was challenging and helpful. Generally speaking, I enjoyed the creative approach to the class.

8. I feel that we gain a good understanding of the subject by doing the homework. I felt grading on the quizzes was quite stiff.

9. Homework B helped to create an interest and desire to study the subject more in depth. The method of reasoning and necessity of resource materials work together to give a deeper appreciation for its subject and its realistic significance in our lives. homework B was also very practical and applicable to everyday situations in industry. To grasp concepts and not just formulas is the factor that makes education worthy of its goals.

   My perceptions of homework B was rather a love-hate relationship. After the homework was done I was delighted, but the agony of it all was intense. I guess you could refer to it as, "The Agony and the Ecstasy."

10. The homework managed to convey a sense of purpose to unconnected bits of data accumulated along the way. It seemed that we did less work with more emphasis on a main idea. In other words, instead of working one hundred, typical second semester, homework problems, the concepts were delivered in one "overall" approach. Having not a smattering of an idea of the real (chemist's) world, these problems gave sense to chemistry in a practical way. I liked this approach to calculation!

11. The homework/quizzes will be valuable because I think they demand what would be expected of students at a university. They were extremely challenging and we were really expected to know and understand concepts in a way that I've never had to. If I had the time that this type of chemistry demanded, i would have had more fun. This class had demanded more time than any other course I've ever had. i think being forced to think about the questions and only wished I was in a position to earn everything i could have from this course.

12. Homework: What I like: The homework is more than mindless drill. And you certainly need a good grasp of the subject material to do the homework well. The projects were fun to think about.

    What I don't like. Sometimes I felt that I needed more practice with the "nuts and bolts" before taking on the homework.

    Quizzes: What I like: Much like the homework, it was more than mindless drill. They were fun to do--most of the time---good integration of concepts.

    What I didn't like: Not really knowing exactly what to expect; either before or during the test.

    Suggestions; A mix of drill and application type questions for homework.

13. The homework and quizzes are of value because they require one to ask and answer the question of "why?" One must follow the exact process required to solve the problem and to explain it in written words. This type of homework requires a greater understanding of the concepts rather than memorizing facts without the ability to manipulate them. The negative aspect of pursuing such depth in one or two questions is that other areas and procedures are not studied in much detail. The study of the lacking areas could be taken upon by oneself but the knowledge goes untested and uncritiqued.

14. The homework I believe is too long, because to understand the homework you also have to do the work at the end of each chapter in addition to the "B" questions. I feel the quizzes show how much knowledge the student actually has. I say this because unlike multiple choice where you can rule out some answer, these quizzes made you do the whole problem.

15. As far as the homework is concerned, I think it is a good way to learn the material. My problem was that I didn't always see what the question was asking for. This type of homework makes you think about what you're doing and why you're doing this. It's more than just knowing how to calculate things, which I think is very good. Although I found it hard, I would much rather it than the questions in the book, because I am getting a better understanding of chemistry.
The quizzes were very difficult.

16. The homework required (forced) me to learn and apply some real study skills which I am sure will stay with me for a very long time. The course, homework, quizzes are hard but that is to be expected. I myself feel that the (B) homework students may get a little more out of the course. I 'm sure with the knowledge that comes out of chem 1B will allow me to understand and appreciate more of what is going on in the world. I can't think of anything i didn't like aside from the fact that the homework and quizzes were hard.

17. The homework was very challenging for me, especially at the beginning of the semester. But I admit that by doing the homework problems, I gained a better understanding of the concepts of the chapters and also how they can be applied to different situations in life.

    I disliked writing the concepts for each problem, however, and having to explain my calculations in each step. It made the time I spent for doing the problems, longer. But it did help me to understand the concepts better.

18. The homework and quizzes were a gigantic challenge for me since I have never been faced with these kinds of problems before. It was and still is very difficult for me to accomplish problems where I have to state concepts a person needs to know and then explain the process in which a person must follow to solve the problem. If a person can do these problems successfully, there is no doubt in my mind that the person understand what he is doing. In that respect, I like these problems.

    The quizzes we had to take and the homework we had to do were considerably harder than what the other group had to do and I don't like the idea that both groups are graded on the same level.

I do think that the homework we have done and the quizzes we have taken will help me in the future because I have to study more and the types of problems we have done are more applicable to life than just numbers.

19. I think it is a great technic to learn the chemistry by doing the (B) type, but it takes more time to do the homework. I didn't like the grading. But after all, I think they will help me in a more organized way to do things later and be more precise.

20. The homework was very hard for me and although I tried my level best it seemed like I was not getting a very good grade on the homework or quizzes. This has been the toughest chemistry course that I have done, and although I am having difficulties doing the homework and quizzes, the challenge has taught me to work harder and this is the type of work that I will be faced with in the future.

21. I feel that the type of homework which has been assigned for us is harder than the other, but it has helped me a lot to be prepared for quizzes. I liked the homework, they were challenging. The quizzes and homework have helped me a lot to get the basic concepts and knowledge and to understand the entire chapter.

22. The homework and quizzes helped me to develop a basic understanding of the chemistry concepts for this course and helped me keep my mind alert (this is a good thing).

23. I find that homework is more helpful for my comprehension of concepts. I like this type of homework and quizzes. However, sometimes I don't like it because it takes time.

24. (no written comments)

A SECOND LOOK:

# STUDENT PERSISTENCE AND ACHIEVEMENT: AN EVALUATION OF THE EFFECTS OF AN EXTENDED ORIENTATION COURSE

A RESEARCH PROJECT CONDUCTED BY
EDWIN STUPKA
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SPRING SEMESTER 1989

## OVERVIEW

### Introduction

Colleges with open-door admission policies are being challenged to find cost effective ways of increasing student persistence and achievement. Retention data clearly indicates that many students will fail to achieve their full academic potential without an effective early intervention. Although this need extends across the spectrum of students, it is urgent that we develop efficient, cost-effective ways of providing support for students under-represented in higher education.

### Background

This college, like many open-door institutions, has developed several model intervention programs that have been shown to be successful in supporting student achievement and persistence. However, several common factors hamper the expansion of these programs:

1) Limitations related to the early identification of the target population.

2) Difficulty in communicating the intervention program to the target population in a timely fashion.

3) These programs required high ratio of professional staff members to students seriously hampering their expansion.

This research project is an attempt to gather educational outcome data related to an intervention course uniquely designed to improve the academic performance of students who have a wide range of abilities and backgrounds using normal staffing ratios.

## Problem

The 1987 to 1989 drop-out statistics published by the National Center for the Advancement of Educational Practices indicates an appalling national drop-out rate among first-time students at open-door institutions of over 47%! We can no longer afford to under-utilize our human resources or ignore the need for more effective ways of supporting students to be successful. This research report is an attempt to measure and compare the performances of two matched groups of students, only one of which enrolled in a cost-effective learning experience especially designed to support students success.

## Purpose

The purpose of this research was to examine the educational outcomes of an especially designed course and compare these results with that of other matched students.

The major focus of this unique course is to empower a broad spectrum of students to assume more responsibility for and become more actively involved with their own education. A learning experience presented in this manner teaches more than the knowledge and skills needed to become successful students. It increases the learner's awareness of the power they have over their own lives. Emphasizing their responsibility for learning, while providing them with the strategies, techniques, and tools they need to become independent (but not isolated) learners, enables them to experience the fact that no one has more control over input or a greater vested interest in the outcome of their learning experience than the individual learner.

## Assumption

Students who learn about, select, and put into practice ideas, strategies, and techniques that other students have found useful will likely improve their academic performance. They will not only develop more effective study skills and life skills but will be more likely to become actively involved in career-life planning and use a variety of resources to support their success. As a result they will more likely:

1) Use more active learning techniques.

2) Develop specific educational goals.

3) Seek out academic support as needed.

4) Make fewer mistakes in developing and executing their educational plan.

Further, it is anticipated that these overt behavioral changes will result in improved performance and persistence as measured by one or more of the following standard measures: units completed, grade point average and/or a lower drop-out rate.

## Hypothesis

The null hypothesis is that when comparing standard measures of academic performance and persistence, there will be no difference between the performance of two comparable groups of students when only one group enrolls in an extended orientation course.

## Review of the Literature

The idea of offering an orientation course is not a new one. Boston University first offered such a course in 1888. Northern Iowa State University had an orientation course before 1890. The first orientation course offered for academic credit was at Reed College in Portland, Oregon in 1911. The number of institutions offering an extended orientation-type course gradually increased over the years. There was a surge of interest immediately after World War II. With the extended orientation concept not fully developed, many institutions, failing to assess its importance for the general student body, shifted their focus toward providing support for high risk students.

In the 1970's, as enrollments plateaued and began to decline, retention became the new buzz word in higher education. This created a renewed interest in the extended orientation concept. The institutional interest in offering such a course has developed rapidly over the last six years. Now, according to the American Council on Education's 1984 Campus Trend survey, more than two-thirds of the nations' 3,300 post secondary education institutions have courses generally described as "coping with college."

The extended orientation concept can be defined as a structured learning experience lasting the entire first term. It provides first-time college students with critical information and skill-building experiences in a positive learning environment. Most institutions offer the course for credit. This is an important institutional statement that helps convey to students the value and importance the institution places on this course. While there is not a clear consensus on whether the course should be graded pass/fail or by letter grade, the majority of colleges offer it as an elective rather than a required course. There is general recognition that the timely introduction of information, techniques, and ideas that support student success is of critical importance and can best be accomplished in a course that lasts the entire first term, rather than in a concentrated format immediately before registration or during the first week of the term.

Over the last ten years, there has been a growing interest in providing students with more assistance as they enter college. "Increasing Student Competence and Success," a four-year study sponsored by ACT National Center for the Advancement of Educational Practices, studied student persistence at 44 public and private colleges and universities. This study recommended six strategies to improve student success. Their first recommendation addresses the importance of a term-long orientation course.

> "Probably the single most important move an institution can make to increase student persistence to graduation is to ensure that students receive the guidance they need at the beginning of the journey through college to graduation. This early guidance can also assist them in acquiring the competence, through the formal general education curriculum, that they will need to complete their courses of study and function effectively after graduation.
> At its best, this guidance system should include the following features:

New student orientation should begin well before students arrive on campus and should continue as a formal course during the first term on campus."

Belcher, et al, (1987) reported on the performance and persistence of two comparable groups of students. One group was composed of students randomly assigned to an extended-orientation type class. The remaining students did not take the course. It was determined that the two groups had similar levels of basic skills. There were approximately 1,000 students in each group. Two years later, 63% of those who were enrolled in the support course were still attending vs. 40% of these in the control group. The experimental group also completed a higher credit load and had a higher percentage of students with a GPA of 2.0 or higher. They concluded that in the semester studied if all first term students had taken the course and attained similar results, there would have been a significant increase in college income ($237,700).

La Voy (1986) used another approach to control for self-selection. He created a large pool of names of first-term freshman who had indicated an interest in taking an extended orientation-type class. From this pool the experimental group was randomly selected. Those not selected from this selection pool became members of the control group. Although the experimental group had slightly lower high school G.P.A. and ACT composite scores, they outperformed the control group during each of the first two quarters.

The experimental group completed more credit hours per student, earned a higher GPA, and posted a higher retention rate. When local predictors of graduation based on third semester performance were applied, it was predicted that a larger percentage of the experimental group will likely graduate.

In another longitudinal study, Oxhandler (1987) found in a two year study that students enrolled in a term-long support course their first semester consistently outperformed other freshman with the same or higher ACT scores. The experimental group had lower attrition rates and higher GPA. On a percentage basis, they also had fewer students with less than a 2.0 GPA and more students with GPA's of 3.0 or higher.

In the study used as a model for this research project, Stupka, 1985 examined the performance of three groups of students, only one of which enrolled in an extended orientation course. He found that those enrolled in this special course:

1. completed more college credit
2. earned a higher G.P.A.
3. Had a lower drop out rate

In all three areas these differences were significant at the 5% level.

In a follow up study four years later, Stupka, 1989 found the experimental group continued to outperform the others. The control group completed 40% fewer units of credit than the experimental group.

Defain and Gould (1987) reported on a longitudinal study examining the impact of a one semester hour class taken during the first semester on campus. They reported a statistically significant positive difference in the performance and retention rates of students who took the class in each of the four semesters studied.

The effect of an extended orientation course on improving student relationships with the faculty and the college was examined by Starke (1989). She found statistically significant differences in each of seven measures of faculty-student relationships. Statistically significant differences were reported in the number of extracurricular activities participated in, the number of college services used and students' commitment to their college. During a three year phase-in period for the Freshman Seminar, the percentage of students retained into the sophomore year increased from 58% to 74%. These differences were significant at the 1% level.

No report on longitudinal research in this area would be complete without citing the work done by Gardner and Jewler at the University of South Carolina.

Gardner and Jewler (1985) have developed an extended orientation course called "University 101," which has become a model for dozens of other institutions. The annual conferences on the Freshman Year Experience, hosted by their university, have become important market places for the exchange of ideas and information related to extended orientation.

A formal evaluation of "University 101" has been conducted yearly since the course's beginning. Retention rates of freshmen have been a principal focus in evaluating the success of this program. Beginning with Fall 1973 there has been an annual comparison of the survival rates of students who enrolled in University 101 and those who did not participate. Despite the fact that GPA predicted by the University was lower for the experimental group than the control group in all but the first two years of the study, those who participated in University 101 had a higher survival rate one year later every single year.

A number of institutions view teaching an extended-orientation type course as a valued staff development activity for teachers across the campus as reported by Gardner and Jewler (1985), Belcher (1987), Defain and Gould (1987), Oxhandler (1987) and Starke (1989).

Gordon and Grites (1984), in a comprehensive report on the freshman seminar course, presented a global view covering such diverse issues as history and related research, course goals and objectives, course instructor, format and credit, grading, content, course evaluation, and related political issues. Their concluding statement reads in part:

> "Traditionally students generally entered college after a preparatory high school curriculum; they were prepared for college academically and anticipated the college experience in traditional ways. Many of today's students are older, come from different vocational backgrounds, attend part-time, or are not as well prepared academically as students in the past. The "new" students need more initial contact and guidance if they are to survive. A freshman seminar course is an effective method of providing this structure and support."

Maisey-Ireland (1985) described the effects of orientation in consumer terms. As students become more skilled and knowledgable, they begin to take education more seriously, and trial-and-error behavior is reduced. As the quest for "full value" for the time and effort invested continues, the ownership in one's education increases and so does the focus on educational quality. Nieves (1978) suggested that helping minority college students develop self-control is an important way of contributing to their academic success. He argued that this can best be done through carefully planned and executed support programs at the beginning of their college journey.

Upcraft (1984) and (1989) see the growing need for extended orientation programs as being related to both societal and individual factors. He states that if a college or university understands those factors that enable students to succeed, it can develop an orientation program that compensates for student deficiencies, enhances student strengths, and provides maximum opportunities for student achievement.

The value and importance of front loading the college learning experience with an extended orientation course for the students of the 80's and 90's was discussed in a paper by Stupka (1988). After discussing several ways students can be empowered to become more actively involved, he concluded that all new students should have the opportunity to enroll in such a course. Because of the comprehensive nature of this paper retention experts chose it for universal distribution at the National Conference on Student Retention two years in a row.

The need for and importance of a more structured and supportive learning experience for beginning college students was also cited by Anderson (1984).

Other writers have also linked extended orientation with student retention. Noel and Beal (1978) identified institutions that had exemplary student retention programs. Virtually every retention program listed orientation or extended orientation programs as a major part of their retention efforts.

A number of variables related to persistence and achievement have been examined. Garnett, (1987) examined the performance of two groups of high risk freshmen. The experimental group who enrolled in a support course were belatedly found to have significantly lower ACT scores than the control group. However, the experimental group earned a higher GPA than the control group. The differences in both the ACT scores and GPA earned were significant at the 5% level. In a later study (1989) he reported that an extended orientation-type course was a major part of the strategy used to support the academic success of 1) conditionally admitted freshman, and 2) suspended students. From 1984 to 1988 the senior class grew by 30.5%. Most of the growth was attributed to the effects of this course.

A pre-test/post-test research design was used by Moralez (1988) to determine if there was a difference between the reading levels of an experimental group who enrolled in a three credit hour extended-orientation course when compared to a similar group of students who were not enrolled in the support course. The differences between the post-test reading scores and pre-test scores were analyzed statistically. Students in the experimental group showed greater improvement in reading. This difference was significant at the 5% level.

After surveying a sample of community colleges nation-wide, Slagle (1988) concluded in her report that orientation needs to become an on-going process for all first-time college students.

Of the dozens of studies that have been conducted over the last few years at colleges and universities of various types and geographic locations, no two studies have used the exact same research approach. However, all of the studies examined report positive results for students taking extended orientation-type classes. This research clearly indicates that, when comparing the performance and/or persistence of similar groups of students, those who took such a course did, as a group, exhibit one or more of the following measurable characteristics:

1) Completion of more units of college credit.
2) A higher GPA.
3) A higher rate of persistence.

In summary, this review of the literature found broad support for using a term-long course as a vehicle to provide assistance, support and direction to both new and returning students. In the words of one research report "front loading the college learning experience with such a course 'vaccinates' students in order to reduce their chances of incurring 'academic difficulty' and/or the feeling of being isolated." In addition there is growing evidence that supports the statement that taking such a course results in increased academic achievement and persistence.

## METHODOLOGY

### Study Design

A treatment-no treatment research design was used in this study. Matched pairs of students were used to establish internal validity. Individually, students from the two groups were matched on four predictors of academic success: 1) recommended reading placement; 2) recommended writing placement; 3) highest math course completed; and 4) number of hours working while attending school. These factors were judged to be the best predictors of academic success available at this institution. The dependent variables were: 1) GPA; 2) number of college credit hours completed; and 3) drop-out rate.

Instructor bias was not considered to be a factor since the College Success course was taught by six different instructors.

Although this study is an attempt to replicate an earlier study, it differs from the original in several significant ways that improved the over-all study.

1. The experimental and control group have a common history. None had previously completed any college work and had completed the same matriculation process.

2. With more data available as a result of matriculation, more powerful predictors of academic success were used to match students. Instead of using sex and age, highest math course completed and number of hours working while in school were used.

3. With the additional dollars available to support matriculation efforts, it is likely that students who completed the matriculation process were more informed and better prepared to begin college than the control group from the previous study.

### Populations

Students who met the following criteria were included in the selection pools used for matching:

1) Had completed no college work previously
2) Had completed the assessment process
3) Participated in a standard matriculation process
4) Were officially enrolled at the beginning of the fourth week of instruction.

Group One selection pool consisted of all students who met the criterion outlined above and enrolled in College Success. This group of 57 students is referred to as a Group One CS selection pool from which matched-pairs of students were selected.

Group Two selection pool consisted of students who completed the matriculation process (MP) and enrolled in classes but did not take College Success. In Spring 1989, 952 students completed MP. For this study, a more easily managed population was created by using a table of random numbers. From this sample, students who met the selection criteria and were included in the Group Two MP selection pool of 76 students. The only perceived difference between these two selection pools was that the experimental group enrolled in Human Development 2, College Success (CS).

Discuss of Matching Procedure

To begin the matching procedure, data cards from the MP selection pool were organized by 1) recommended reading placement and 2) recommended writing placement.

On a random basis an attempt was made to match a data card from the CS selection pool with a data card from the MP selection pool, using the following procedure: first matching reading and writing combined; then highest math course completed, and then hours worked. Since both math and hours of work each had six categories, making perfect matches was impractical. Therefore, it was considered a match if the attempted match was within one level in math or hours worked. If a CS data card did not match, the unmatched data card was eliminated from the study. This matching procedure resulted in identifying forty pairs of students matched on all four criteria:

a) Recommended reading placement
b) Recommended writing placement
c) Highest math course completed
d) Number of hours working while in school

Procedure

A description of the course used as the focal point of this study.

Human Development 2, College Success, is a three semester unit class taught over eighteen weeks. The 54 hours of instruction covered these four main areas:

1) Study Skills: This includes time and/or task management, organizing for academic success, the Rules of Active Learning, memory development, reading improvement, note taking, and test taking, library usage.
2) Life Skills: This includes creativity, relationships, health, money, resources, what next, and goal setting.

3) Introduction to Career-Life Planning:
   - o selected assessment activities
   - o networking
   - o career center activities
   - o worker interviews
   - o discussions on the value, importance and limitations of work experience.

4) Orientation to College: Rules, regulations, policies, procedures, requirements, resources.

The instructor assumes the role of director of learning activities. A conscious effort is made to divide the class time each week using the following suggested guidelines:

10% Review and Preview
10% Assignments and announcements
20% Lecture and Guest Speaker
20% In-class exercise
20% Evaluation and feedback
20% Conversation and sharing

Students are encouraged to develop independent learning skills using a variety of ideas, strategies, and techniques, including regular use of study cards, time plans, and study groups. Early in the semester students are asked to make a written commitment to earning a quality education. Throughout the semester students receive academic coaching from peers and the instructor. The importance of adhering to the official college guidelines on attendance and homework is emphasized.

## Data Collection

At the end of the semester the official transcripts of all students in both groups were collected. Students who were enrolled at the beginning of the fourth week of instruction but failed to earn any college credit were identified as drop-outs.

## Statistics

The statistical analysis involved a group by group comparison of the following:

1) Units of college credit earned
2) Drop-out rate
3) Grade point average

Population 1 Beginning college students who enrolled in College Success.

Population 2 Beginning college students who did not enroll in College Success.

Test 1 Comparing the Means of the Units Completed

$\mu_1$ = mean of Population 1

$\mu_2$ = mean of Population 2

$H_o$: $\mu_1 - \mu_2 = 0$ There is no difference in the means

$H_a$: $\mu_1 - \mu_2 > 0$ The mean of Population 1 is greater than the mean of Population 2

The level of significance is 5%
The test statistic is

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

If $Z > z_c$ (=1.65), then reject $H_o$.

With $n_1$=30, $\bar{x}_1$=7.85, $s_1^2$=12.778, $n_2$=22, $\bar{x}_2$=5.86, $s_2^2$=11.742:

$$Z = \frac{7.85 - 5.86}{\sqrt{\frac{12.778}{30} + \frac{11.742}{22}}} = 2.03$$

Conclusion: Since 2.03 > 1.65 reject $H_o$.

Using the given data there is significant evidence at the 5% level to conclude that CS students earned more units of college credit than MP students.

Test 2 Comparing the Means of the GPA's

$\mu_1$ = mean of Population 1

$\mu_2$ = mean of Population 2

$H_0$: $\mu_1 - \mu_2 = 0$ There is no difference in mean

$H_a$: $\mu_1 - \mu_2 > 0$ The mean of Population 1 is greater than the mean of Population 2

The level of significance is 5%
The test statistic is

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

If $Z > z_c$ (=1.65), then reject $H_0$.

With $\bar{x}_1$=2.62, $n_1$=30, $s_1^2$=1.176; $\bar{x}_2$=2.59, $n_2$=22, $s_2^2$=1.282:

$$Z = \frac{2.62 - 2.59}{\sqrt{\frac{1.176}{30} + \frac{1.282}{22}}} = 0.10$$

Conclusion: Since 0.10 < 1.65, do not reject $H_0$. Although CS Students earned a slightly higher GPA, the difference was not significant at the 5% level.

Test 3 Comparing Drop-Out Rates

$P_1^* = \frac{10}{40} = 0.25$

$P_2^* = \frac{18}{40} = 0.45$

$H_0$: $\pi_1 - \pi_2 = 0$ No difference in drop-out rate

$H_a$: $\pi_1 - \pi_2 < 0$ Drop-out rate of Population 1 is less than drop-out rate of Population 2

The level of significance is 5%
The test statistic is

$$Z = \frac{P_1^* - P_2^*}{\sqrt{\frac{P_1^*(1-P_1^*)}{n_1} + \frac{P_2^*(1-P_2^*)}{n_2}}}$$

If $Z < z_c$ (=-1.65), then reject $H_0$.

With $n_1$=40, $P_1^*$=0.25, $n_2$=40, and $P_2^*$=0.45:

$$Z = \frac{0.25 - 0.45}{\sqrt{\frac{(0.25)(0.75)}{40} + \frac{(0.45)(0.55)}{40}}} = -1.92$$

Since -1.92 < -1.65, reject $H_0$.

Using the given data there is sufficient evidence at the 5% level to conclude that CS students drop out of college less often than MP students.

Limitations

1. Self-Selection Bias

Any study that includes students who are self-selected into the treatment process has a built-in bias. This researcher acknowledges the self-selection bias as one of the limitations of this study.

The following steps were taken to limit the effects of this bias:

A. A quasi-experimental research design was used.

B. The internal control variables judged to be the best available predictors of academic success and thus most likely to have an effect on the dependent variables were identified as:

(1) recommended reading placement
(2) recommended writing placement
(3) highest math course completed
(4) number hours working while attending school.

C. The internal validity of this study was established by using the matched-pair technique to identify pairs of students from the two selection pools who were matched on all four control variables.

2. Only students who completed the matriculation process were included in this study. Since MP is required only of students taking more than 6 credit hours those who did not complete the matriculation process were systematically excluded from this study.

3. Because the best prepared students tend to enroll in College Success less frequently than less well prepared students, this sample is probably not a true cross-section of the new student population. Since the MP control group were matched to the CS group it is likely that this matching resulted in both groups of students being more "at risk" than the general population. Therefore, it is important that these results not be generalized to the total new-student population.

FINDINGS

The Results

CS students out-performed the MP group on all measures of academic performance and persistence, as shown in the following display.

Statistical Data Comparing:
College Success (CS) Students
with
Matriculation Process Students

| | | N | Dropped out/ Completed | x | s | p* | zc = 1.65 at 5% level 1 tailed test | z score |
|---|---|---|---|---|---|---|---|---|
| Units Completed | CS | 30 | | 7.85 | 12.778 | | 1.65 | 2.03 |
| | MP | 22 | | 5.86 | 11.742 | | | |
| GPA | CS | 30 | | 2.62 | 1.176 | | 1.65 | 0.10 |
| | MP | 22 | | 2.59 | 1.282 | | | |
| Dropout Rate | CS | | 10/30 | | | 0.25 | -1.65 | -1.92 |
| | MP | | 18/22 | | | 0.45 | | |

This chart shows that CS students outperformed MP students on all three measures of academic achievement and persistence. These differences were at the 5% significance level when comparing units completed and drop-out rate. The difference in GPA was not statistically significant.

## Conclusions

Using the given data, there is sufficient evidence at the 5% level to conclude that College Success does result in significant positive differences in the number of units completed and drop-out rates of matched groups of students.

Although CS Students showed a slight GPA advantage, it was not significant at the 5% level. With a statistically lower drop out rate for CS Students, it is speculated that more high risk students stayed in school and thus probably depressed the group GPA.

There is no evidence that completion of the matriculation process contributed to the persistence of the control group.

## Discussion of the Findings

These findings are consistent with other related research. They are particularly important because:

1) CS is open to students with a broad range of academic abilities and is thus relatively easy to introduce to beginning students.

2) The results were obtained by using a number of different teachers teaching the course. This demonstrates that the results are not related to the special or unique skills of one or two teachers. As mentioned in the Review of the Literature, many institutions view teaching such a class as a valuable staff development activity in which professional staff members from across the curriculum are encouraged to participate.

3) The student-to-teacher ratio is within the standard staffing parameters, thus making the expansion of CS a cost-effective option.

Three percent of the CS grades compared to none of the MP grades were "Incomplete." Since this grade is an instructor grading option it is usually preceded by a dialogue between the instructor and the student. This may be an indication that CS students establish better rapport with instructors.

Over the last eight years almost 4,000 students at this institution have enrolled in CS. In anonymous end-of-semester course evaluations, 95% have indicated that they benefitted from the course and would recommend it for their friends.

The following statements are given as a sampling of student comments about the course.

"As I come to the end of the semester, I see the rewards of my short hours of sleep. I have benefited a great deal from this course. It must sound funny but my life will never be the same!!"

"This course changed my life!!"

"For the first time in my life I feel like I'm in charge."

"I use the things I learned in this class at home as well as at school."

"This is the first time that I really enjoyed learning."

"Lots of work, but it really paid off with 3 A's and a B."

"Can't see why this course isn't required of all new students."

## SUMMARY

Colleges with open-door admission policies are being challenged to find efficient, cost-effective ways of increasing student persistence and achievement. The need is particularly great among under-represented students in higher education. The major focus of the treatment course in this research report is to enable students to experience the fact that no one has more control over input or a greater vested interest in the outcome of their learning experience than the individual learner. Students who learn about, select and put into practice ideas, strategies and techniques that other students have found useful in supporting academic success will likely outperform comparable students. The course demonstrates that student performance can be improved by a course that addresses a broad spectrum of needs including the development of self-esteem and self-management skills. The resulting increased level of personal involvement is reflected in higher levels of academic performance and/or persistence. Students who learn how to be independent learners can apply these same ideas, strategies and techniques in new and challenging situations for the rest of their lives.

By comparison, the traditional approach to instructional intervention has focused primarily on developing such academic skills as reading and writing or mastering course content. While these approaches are important, without supporting self-management skills (e.g., time/task management, decision making, goal setting, and active learning strategies and techniques), increased academic performance is sporadic. Students need help in developing both self-esteem and self-management skills. Hopefully, this study will contribute to the re-examination of how to support students to be more successful in school. With broad institutional support in communicating to both faculty and students the importance and effectiveness of such a course, a number of institutions report 1/3 or more of the new students elect to take this course. The review of the related literature strongly supports the idea that such a course does have a significant effect on student achievement and/or persistence.

Recommendations

While an extended orientation course does not guarantee academic success, it is the belief of this researcher that no other instructional intervention combines these factors:

1) Evidence of increased academic performance and persistence.

2) Improved performance by a broad spectrum of the student population.

3) Although most institutions require pre-service training, faculty members from across the curriculum have successfully taught such a course. Specially trained or credentialed experts are not required.

4) The student-teacher staffing ratios are consistent with usual practices.

Therefore, it is recommended that colleges re-examine their commitment to academic excellence in light of the growing body of research concerning the importance and effectiveness in supporting student achievement and persistence via a multi-unit, term-long course specially designed for beginning students.

Although extended orientation in not a panacea for all the ills found in higher education the growing body of educational research reveals promising results for a broad spectrum of students. A massive effort is needed to inform and education students about the value and importance of such a course. Every new student should be encouraged to enroll in such a course their first term.

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# THE MBTI IN THE COLLEGE WRITING CLASS

A RESEARCH PROJECT CONDUCTED BY
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SPRING SEMESTER 1989

## OVERVIEW

Recent research and theory concerning the nature of writing instruction suggests that a major paradigm shift has taken place. Traditionally, writing instruction has been seen as explaining grammar and mechanics and giving students practice in applying certain rhetorical skills by writing in "modes" such as the comparison and contrast essay, the description of a process, or the analysis of cause and effect. The emerging paradigm in writing instruction acknowledges a deeper complexity in the development of writing abilities. It deals with the dynamics of the writing process rather than with the ideal perfection of the written product and it focuses on questions of the writer's empowering, meaning-making, self-understanding, self-representation, and contexts that have been relatively ignored in the past.

As a teacher of writing who was in the classroom before this paradigm shift began, I have continually worked to find ways to develop and apply methods that make it possible to realize the teaching objectives that the new paradigm envisions. One possibility seems to lie in the incorporation of the Myers-Briggs Type Indicator (the MBTI) into writing instruction. There has been some research on the use of the MBTI in writing (most notably, that of Jensen and DiTiberio, 1985). It seems that the MBTI could be particularly relevant as a means of incorporating the writer's orientation and sense of self into the writing process. Given my concern to synthesize authoritative standards with an evocative student-oriented process, I want to determine whether the use of the MBTI--not to diagnose and categorize students but rather to focus on and build from students' own strengths of personal orientation as they see them--might make my writing classes more effective for students. It is the purpose of this research project to answer this question: "Does the use of the MBTI as an instrument of student self understanding increase the effectiveness of my writing instruction?"

METHODOLOGY

For the spring semester I taught two daytime sections of college writing. Each section had beginning enrollments of about twenty-three students. One was to be used as an experimental group and the other as a control group. Both classes had the same syllabus, the same readings, the same writing assignments, and the same general classroom procedures (including writing journals and regular draft-response groups). The MBTI was administered to the experimental group. The MBTI is described in the literature as "an untimed, 126-item, forced-choice self-report inventory yielding four dichotomous scores that measure preferences for Extraversion-Introversion (EI), Intuition-Sensation (NS), Thinking-Feeling (TF), and Judging-Perceiving (JP)." The experimental class was given a session with Jerry Rudmann, the Irvine Valley College psychology instructor who was also the research advisor for this project, to orient them in how to interpret its meaning. In addition, the students in the experimental group also wrote responses to each of the four areas of their test results in their journals. They wrote at different times in the semester relating those results to what I presented of the dynamics of the writing process in both the experimental and control classes. From time to time they worked in groups based on the test results. Those results--the sixteen categories in the MBTI--were almost daily referred to by students and by me in relation to class dynamics and class work.

Assessments of both classes consisted of portfolios of formal writing that they produced in their work during the course of the semester, concluding one page self reports under the title "I am a Writer" (see the Findings section below), and beginning and ending administration of the Writing Attitude Scale, a twenty item multiple choice test presented in Reigstad and McAndrew (see Figure 1). Entry level abilities and attitudes were not significantly different between the two classes.

Figure 1. Writing Attitude Scale Question Form (Reigstad and McAndrew, 38).

## Writing Attitude Scale

There are no right or wrong responses to the following statements about writing. Please indicate as honestly as possible how you feel about each statement on the scale provided.

| strongly agree | agree | uncertain | disagree | strongly disagree | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 1. I look forward to writing down my own ideas. |
| 1 | 2 | 3 | 4 | 5 | 2. I have no fear of my writing's being evaluated. |
| 1 | 2 | 3 | 4 | 5 | 3. I hate writing. |
| 1 | 2 | 3 | 4 | 5 | 4. If I have something to express, I'd rather write it than say it. |
| 1 | 2 | 3 | 4 | 5 | 5. I am afraid of writing when I know what I write will be evaluated. |
| 1 | 2 | 3 | 4 | 5 | 6. My mind usually seems to go blank when I start to work on a composition. |
| 1 | 2 | 3 | 4 | 5 | 7. Expressing my ideas through writing seems to be a waste of time. |
| 1 | 2 | 3 | 4 | 5 | 8. I don't like my compositions to be evaluated. |
| 1 | 2 | 3 | 4 | 5 | 9. I see writing as having no more value than other forms of communication. |
| 1 | 2 | 3 | 4 | 5 | 10. I feel confident in my ability to express my ideas clearly in writing. |
| 1 | 2 | 3 | 4 | 5 | 11. I see writing as an outdated, useless way of communicating. |
| 1 | 2 | 3 | 4 | 5 | 12. In my major or in the field of my future occupation, writing is an enjoyable experience. |
| 1 | 2 | 3 | 4 | 5 | 13. I seem to be able to write down my ideas clearly. |
| 1 | 2 | 3 | 4 | 5 | 14. Writing is a beneficial skill. |
| 1 | 2 | 3 | 4 | 5 | 15. Discussing my writing with others is an enjoyable experience. |
| 1 | 2 | 3 | 4 | 5 | 16. I have a terrible time organizing my ideas in an essay. |
| 1 | 2 | 3 | 4 | 5 | 17. When I have something to express, I'd rather say it than write it. |
| 1 | 2 | 3 | 4 | 5 | 18. An ability to write will be worthwhile in my occupation. |
| 1 | 2 | 3 | 4 | 5 | 19. I enjoy writing. |
| 1 | 2 | 3 | 4 | 5 | 20. I'm no good at writing. |

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FINDINGS

Writing Attitude Scale

Data from the Writing Attitude Scale were analyzed. Average ratings on each of the Writing Attitude Scale's twenty items were computed for the control group and the experimental group. Then pre test to post test changes in the average rating for each item were compared. Figures 2 and 3 show the results of these pre and post test comparisons item by item. It can be seen that the average rating on most items increased from pre test to post test. For the control group, the four items which did not show a pre test to post test increase in average rating were numbers 9, 11, 17, and 18. For the experimental group, the ten items failing to show a pre test to post test increase were numbers 5, 7, 8, 11, 12, 14, 15, 18, 19, and 20.

A similar comparison for total scores on the Writing Attitude Scale was then conducted. Total scores for each student were calculated by summing the ratings on all twenty items on the Writing Attitude Scale. The pre test and post test total score averages for the control group were 69.9 and 73.8, while the pre test and post test total score averages for the experimental group were 73.6 and 74.9. Figure 4 shows the average item increase across all twenty items for both the control and the experimental group. From Figure 4 it is apparent that the control group began the course much lower on the Writing Attitude Scale than the experimental group and also experienced greater positive change by the end of the semester. The experimental group began the course significantly higher than the control group on the Writing Attitude Scale and, by the end of the course, had also moved to a more positive average on the scale.

Independent groups t-tests were conducted to test for statistical significance between the control and experimental group means. There was no significant difference between the control group and the experimental group on the pre test. Neither was there a significant difference between the control group and the experimental group on the post test.

A series of paired sample t-tests (one-way, .05) was conducted to determine if there were any statistically significant rating increases on individual item ratings between the pre and post tests. For the control group, significant increases in pre to post test item ratings were found for items number 5 and 6. For the experimental group, significant item increases were found for item numbers 10 and 14.

Finally, individual student personality traits as measured by the Myers-Briggs Type Inventory in the experimental group were compared to scores on the Writing Attitude Scale. No trends were found.

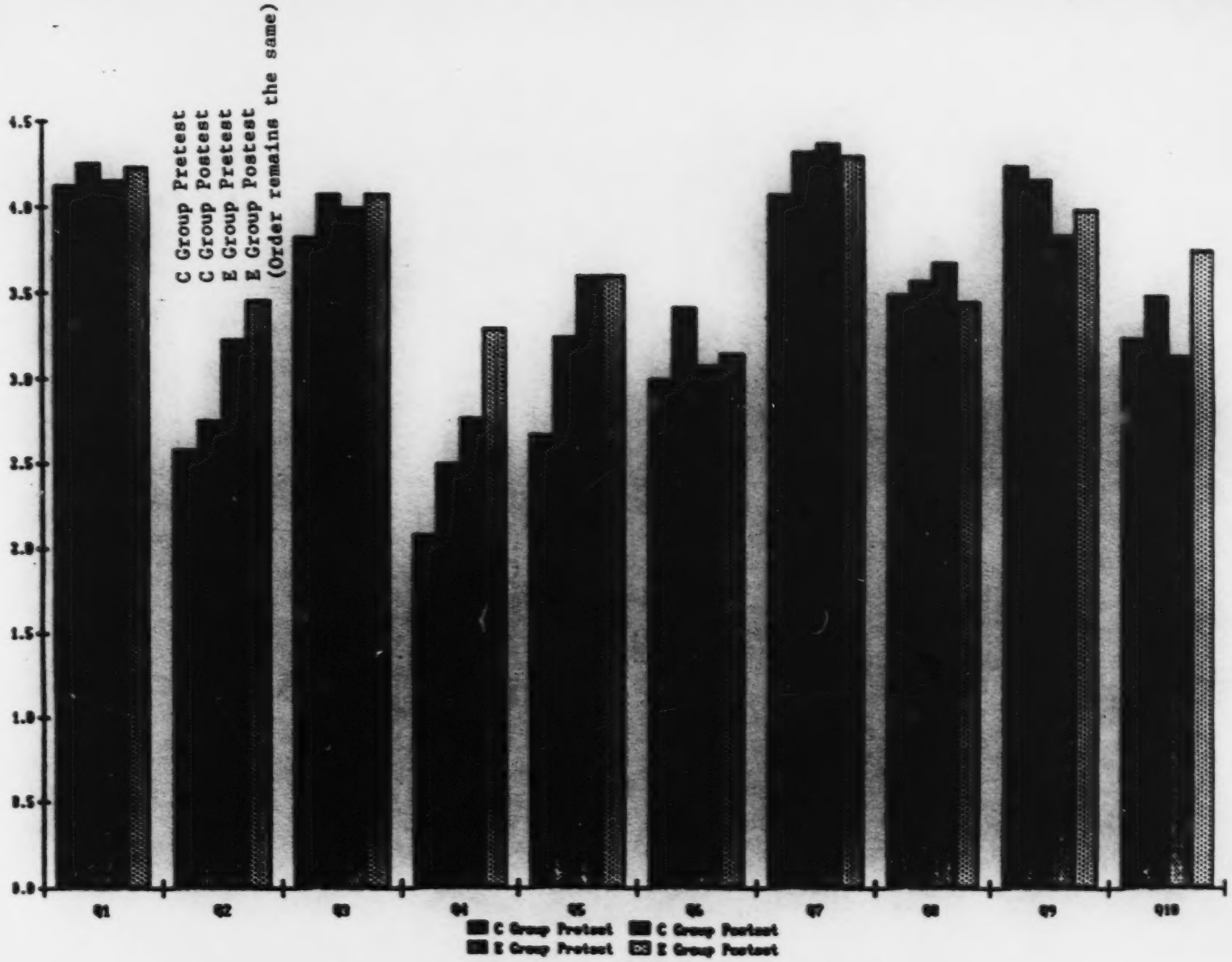


Figure 2. Comparison of average item ratings on the pre test and post test for the control and experimental groups on the Writing Attitude Scale (items 1-10).

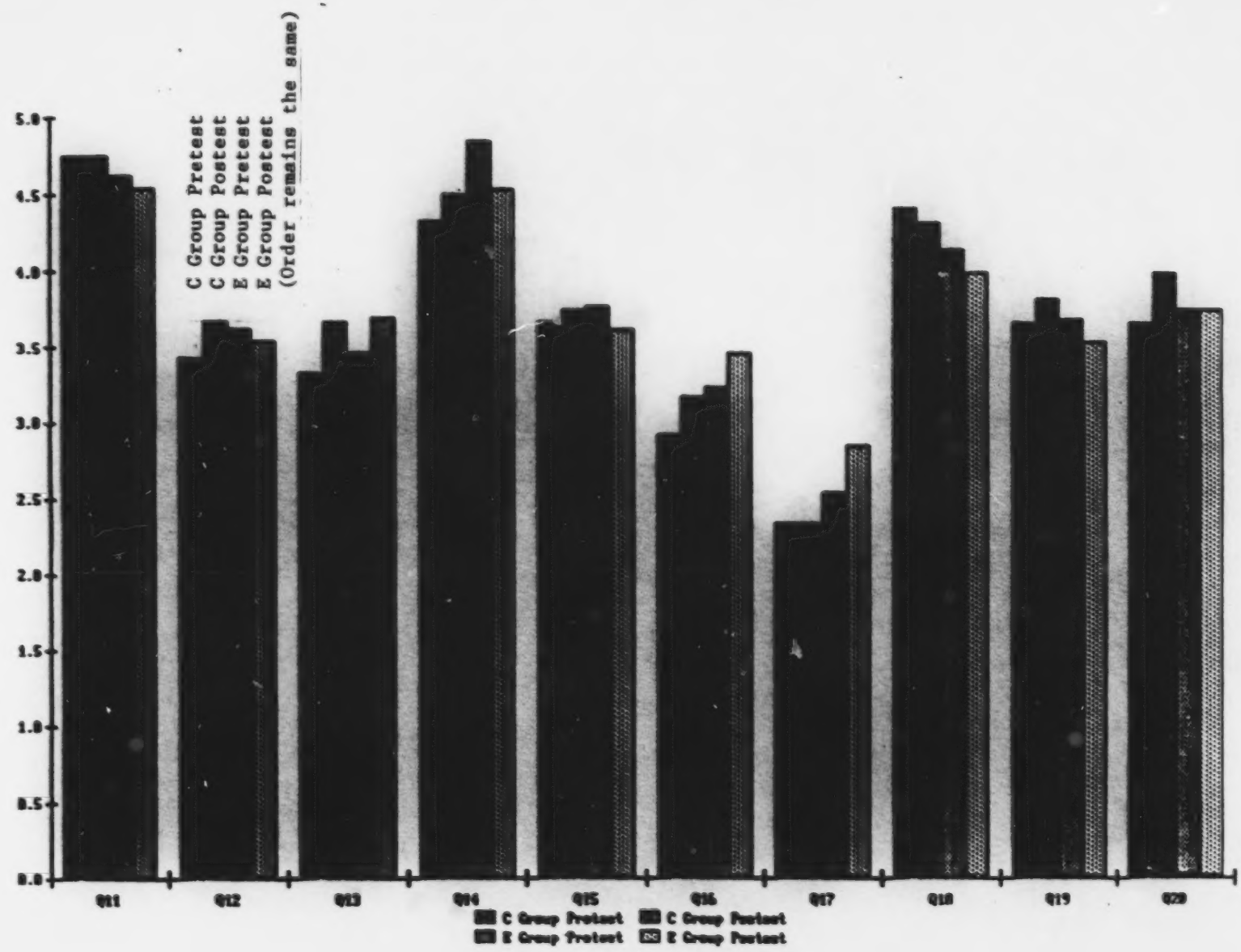


Figure 3. Comparison of average item ratings on the pre test and post test for the control and experimental groups on the Writing Attitude Scale (items 11-20).

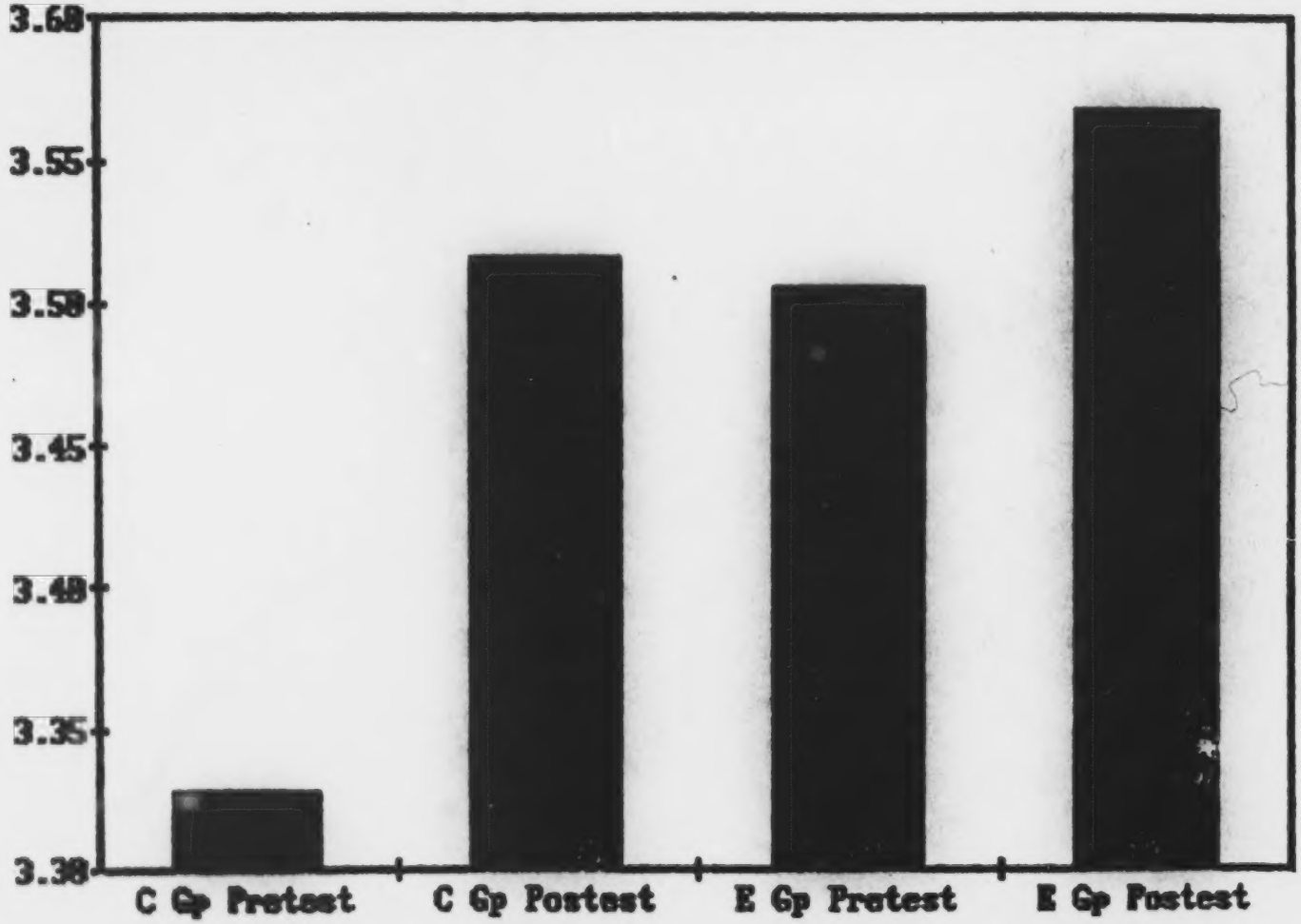


Figure 4. Group averages for the control and experimental groups for both pre and post test scores on the Writing Attitude Scale.

Self Reports

At the end of the semester students were assigned to write a page under the heading, "I am a writer." This prompt simply asked them to express their self understanding as writers. It was given with the belief that self reports provide a kind of data regarding the subjects' perceptions which might complete or complement the data provided by objective measures such as the Writing Attitude Scale. Fifteen students from the control group and fourteen students from the experimental group wrote these essays during a class session.

Students in the control group tended to describe writing as a product--that is, in terms of the old paradigm--a bit more than students in the experimental group did. They also tended to relate to their writing with more distance than the experimental group did. The following sample sentences, marked for emphasis, show these tendencies:

1. My ability gained in school can go to work in my job to help me express accuracy.

2. I write because it basically helps me in organizing my thoughts and ideas.

3. When I am given a topic to write about I can come up with many ideas like how to support or how to disprove the truth of the topic.

4. Through this class and other classes I have learned that I have valuable insights and ideas and can present them, either written or orally, in a clear, precise manner.

5. In my writing inspiration has always been the driving force with structure and organization taking a back seat to pure flowing creativity. The acceptance of the title "writer" is now comfortable with the skill of organization more firmly in place.

In the control group there were some exceptions to this tendency to emphasize the written product and what James Britton calls the "transactional function" of writing. Here is one example:

6. As I write on any topic, I begin to lead the reader through my own realm of ideas.

The statements the students in the experimental group made about their writing seemed more expressive--following Britton's distinction between transactional and expressive writing--and closer to their actual experiences of themselves:

7. If I can't get into the subject it'll drive me crazy to think of something to write. I really can't write unless I'm inspired.

8. I am a writer who takes the topic at hand and incorporates it into my own lifestyle. By incorporating I mean that I take the topic and in some way let it influence me or change my views to better me as a person.

9. I love to express my ideas on paper because I feel I am taking what I am thinking from my head and putting it on paper for others to think.

10. I enjoy writing more this semester because I feel much more confident than before.

11. There is always more to learn (as you write and rewrite) and you can go on forever. Writing outlasts any person or thought because it's all down on paper.

12. I am a woman who writes in order to figure out the world around her.

13. One problem is that I don't ever seem to get done with a paper. I am always changing something right up to the moment I present it to the critic. Maybe that is good. Maybe there never is an end to writing a paper.

These differences between the self reports of the two groups lead me to believe that the attitudes of the experimental and control groups measured by the Writing Attitude Scale reflect only part of the students' total involvement with their work as writers. The discrepancies between the two instruments suggest that the actual nature of the original differences between the two groups and the impact of the use of the MBTI in the classroom are more complex and difficult to pinpoint than either measure, taken by itself, would suggest.

SUMMARY

Given the inconclusive nature of the two different kinds of data gathered in this study, I do not have very much reason to believe that students in the experimental group developed their writing skills in ways or to degrees that were significantly different or better than students in the control group did. However, my perceptions of individual students in both groups were dramatically changed as a result of the experience of working with students and their MBTI results: I could see individual needs and differences among students so that the relationship between student and writing task took on a whole new dynamic in my work with students. I began to see their work in terms of their diverse efforts to make meaning for themselves in the tasks they wanted to succeed with. For example, some tended to be more concerned with conventions. This now makes sense to me in terms of the S and J factors. Others tended to be more concerned to work with their own unique and original perceptions. This tendency now makes sense to me in terms of the N and T or F factors. Such awareness of individual differences among student writers may have a deep and long term impact on my teaching because I have begun to see how the items the MBTI measures work out in concrete terms for individual writers in the process of learning to write. One of the results of this awareness is that I am learning how to support more effectively and more directly the strengths that each of these variations brings out in the different students in my writing classes. Thus, although this particular classroom research project did not result in conclusive support for a specific classroom technique, it was instrumental in developing a greater depth of understanding of the dispositions of student writers and I believe it therefore helped make my teaching more effective in more fundamental ways.

I now believe that further work with the MBTI and writing students would be very valuable in consolidating and extending my skills in meeting the individual needs of those students. I am very grateful for this opportunity to explore this area of teaching--personality types in relation to the dynamics of writing instruction--and I am looking for opportunities and methods to further my understanding of it.

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# PARTIAL CREDIT WITH NOTES AND REWORK FOR HALF CREDIT IN MATHEMATICS

A RESEARCH PROJECT CONDUCTED BY
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SPRING SEMESTER 1989

## OVERVIEW

It is often said that students learn best what they must find out for themselves. As a fairly traditional teacher of mathematics, I frequently find myself correcting my students' mistakes (as in "watch how this is done",) rather than allowing them to discover and correct their own mistakes with my guidance. On exams I routinely write notes to my students, correcting their errors in red ink, and awarding partial credit for partially correct work. If students learn best what they must find out for themselves, then my "partial credit with notes" grading technique may not be giving them the most beneficial learning experience.

A colleague of mine uses an innovative technique for grading exams (innovative to this "traditional" teacher!) In her system a student receives full credit for each test question that he[1] works correctly and zero points if his solution contains even a slight error. He is then given a certain amount of time (typically one or two days) to rework the problem he missed. The student is encouraged to use all available resources to locate and correct his errors. The instructor then regrades the corrected problems and awards half of the original credit for accurate solutions. Incorrect solutions again receive no credit.

My colleague's method, which I have dubbed "rework for half credit," makes the students accountable for locating and correcting their own mistakes. In this regard, they are "finding out for themselves." If the maxim is true, shouldn't "rework for half credit" produce greater learning than "partial credit with notes?" This was the question I investigated in my research project.

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[1] Gender disclaimer: The use of the male pronoun is for convenience only

METHODOLOGY

During the semester of the research project, I taught two sections of elementary algebra, each with first week enrollments of nearly sixty. One section met three times a week (from 11 AM to 12:20 PM) and the other twice a week (from 11 AM to 1:20 PM with one break), but the total weekly hours were approximately equal. The classes used the same textbook and were governed by the same syllabus and policies. The only exception, of course, is that I graded their exams differently.

I chose the Monday/Wednesday/Friday group as my control, i.e., I graded their exams with my usual "partial credit with notes."

The experimental group was my Tuesday/Thursday class in which students had to "rework for half credit" all exam questions they missed. Every student in the experimental group opted to rework problems which contained errors. There were six exams in the semester, excluding the final exam. The final exam was my assessment instrument and was not graded by either method.

During the second week of classes (January 17-20) I tested both classes to establish a base from which growth could be measured. I used a test of elementary algebra skills developed by the Mathematics Diagnostic Testing Project (MDTP) of the University of California and California State University. It is multiple choice and scored by computer. The final exam in both classes was just a second form of the same test. The results of the two exams gave me the raw data for my analysis.

It had been my intention to keep the experiment a secret. Through the student grapevine, however, my students quickly became aware of the differences in the way their tests were being graded. I revealed my motives during the fifth week of the semester. While there is no way to know for sure, I don't believe that the openness of the experiment had any effect on the outcome.

FINDINGS

Tables 1 and 2 contain the raw data and some results derived from the raw data. "ENTRY MDTP" and "EXIT MDTP" refer to the pre- and post-MDTP tests which were used to obtain baseline and exit scores. Test scores are out of a maximum of 50.

There are some considerable differences between the two classes. In particular, the average exit score for the control group (37.08) is 17.2% higher than the average for the experimental group (31.61). However, the significance of this result is minimized when the entry scores are taken into consideration. The control group started out with an average entry score of 17.6% higher than that of the experimental group (15.75 vs. 13.39). The overall average growth (i.e., the percent increase in MDTP scores) is very nearly the same for both groups. Each group improved on the average by approximately 135%.

The experiment apparently had no effect on student retention. The control group began with 56 students and ended with 37, a 66% retention. The experimental group kept 37 out of 58, a 64% retention. The difference is insignificant. (If one more student had dropped from the control group, the retention rates would have been almost identical.)

SUMMARY

"Students learn best what they must find out for themselves." If there is truth in the maxim, it has not been overwhelmingly demonstrated by my research. Students who were required to correct their own errors on chapter tests experienced no more growth in their MDTP scores than those who were shown their mistakes by their instructor. In fact, after accounting for skill differences between the control group and the experimental group, the two grading techniques produced almost identical statistics.

The results are actually encouraging in one respect. I do no disservice to the student by adopting either grading technique. The "rework for half-credit" method is substantially easier for me. Tests can be marked quickly, since it is unnecessary to appraise a wrong answer for partial credit. And even though the tests must be collected and rescored after students have made their corrections, I found that I was still saving time overall as compared with the "partial credit with notes" approach.

Frankly, I am disturbed that the "rework for half-credit" class did not show greater growth than the other class. It is reasonable to believe that a student who plays an active role in his education will, on the average, learn more than one who listens passively to his erudite professor. It may be that there were factors in the experiment which tended to negate the growth that the Tuesday/Thursday class may have otherwise experienced. In particular, since a Tuesday/Thursday class has 33% fewer meetings than a Monday/Wednesday/Friday class, the two classes are certainly <u>not</u> equivalent, despite their equality of semester hours. Abstract concepts, mathematical or not, may require much repetition to be understood, and that repetition is dramatically reduced in the two-day-a-week class. It would be interesting to conduct the same experiment in which the control and experimental groups are reversed. It may be possible to do so, since the M/W/F and the T/Th schedule is typical in our department.

It is worth noting that three students in the experimental group independently expressed appreciation for being "forced" to correct their own mistakes. No one, on the other hand, has <u>ever</u> thanked me for the extensive notes and corrections I make on exams.

TABLE 1 - THE CONTROL GROUP

ELEMENTARY ALGEBRA, MON/WED/FRI, SPRING 1989

"PARTIAL CREDIT WITH NOTES"

| STUDENT ID# | ENTRY MDTP | EXIT MDTP | PERCENT INCREASE |
|---|---|---|---|
| 158279 | 1 | 45 | 4400.0% |
| 252469 | 17 | 31 | 82.4% |
| 257954 | 31 | 43 | 38.7% |
| 260819 | 8 | 30 | 275.0% |
| 291755 | 22 | 40 | 81.8% |
| 307338 | 11 | 46 | 318.2% |
| 328188 | 16 | 31 | 93.8% |
| 345538 | 12 | 41 | 241.7% |
| 401384 | 12 | 34 | 183.3% |
| 401513 | 25 | 48 | 92.0% |
| 405569 | 9 | 21 | 133.3% |
| 411313 | 8 | 43 | 437.5% |
| 411337 | 17 | 28 | 52.9% |
| 418744 | 13 | 32 | 146.2% |
| 418806 | 3 | 27 | 800.0% |
| 419969 | 16 | 44 | 175.0% |
| 425147 | 27 | 41 | 51.9% |
| 426420 | 23 | 40 | 73.9% |
| 426483 | 18 | 39 | 116.7% |
| 427303 | 12 | 46 | 283.3% |
| 427429 | 12 | 25 | 108.3% |
| 427623 | 3 | 17 | 466.7% |
| 428756 | 9 | 21 | 133.3% |
| 428840 | 15 | 29 | 93.3% |
| 429060 | 27 | 45 | 66.7% |
| 429365 | 11 | 44 | 300.0% |
| 429964 | 44 | 49 | 11.4% |
| 431540 | 16 | 48 | 200.0% |
| 431735 | 15 | 48 | 220.0% |
| 436851 | 8 | 41 | 412.5% |
| 437451 | 23 | 39 | 69.6% |
| 438273 | 20 | 32 | 60.0% |
| Mean | 15.75 | 37.06 | 135.3% |
| St. Dev. | 8.92 | 9.09 | |

NOTE: 37 students completed this class, however, complete data was collected on only 32 students.

TABLE 2 - THE EXPERIMENTAL GROUP

ELEMENTARY ALGEBRA, TUES/THURS, SPRING 1989

"REWORK FOR HALF CREDIT"

| STUDENT ID # | ENTRY MDTP | EXIT MDTP | PERCENT INCREASE |
|---|---|---|---|
| 16475 | 3 | 32 | 966.7% |
| 118665 | 7 | 28 | 300.0% |
| 185774 | 15 | 41 | 173.3% |
| 209278 | 14 | 37 | 164.3% |
| 284453 | 18 | 40 | 122.2% |
| 285414 | 10 | 31 | 210.0% |
| 310004 | 16 | 18 | 12.5% |
| 310144 | 19 | 45 | 136.8% |
| 314257 | 5 | 25 | 400.0% |
| 328458 | 10 | 36 | 260.0% |
| 332206 | 10 | 36 | 260.0% |
| 345433 | 20 | 40 | 100.0% |
| 346012 | 16 | 40 | 150.0% |
| 348757 | 8 | 10 | 25.0% |
| 349075 | 20 | 31 | 55.0% |
| 410953 | 15 | 17 | 13.3% |
| 418157 | 4 | 30 | 650.0% |
| 418376 | 13 | 42 | 223.1% |
| 418403 | 8 | 23 | 187.5% |
| 421139 | 9 | 18 | 100.0% |
| 425613 | 11 | 29 | 163.6% |
| 425732 | 14 | 28 | 100.0% |
| 426403 | 13 | 30 | 130.8% |
| 426405 | 11 | 23 | 109.1% |
| 426528 | 11 | 19 | 72.7% |
| 426753 | 22 | 43 | 95.5% |
| 426841 | 20 | 47 | 135.0% |
| 429266 | 18 | 29 | 61.1% |
| 429745 | 18 | 27 | 50.0% |
| 431827 | 9 | 17 | 88.9% |
| 434838 | 6 | 43 | 616.7% |
| 436339 | 27 | 46 | 70.4% |
| 438890 | 22 | 42 | 90.9% |
| Mean | 13.39 | 31.61 | 136.0% |
| St. Dev. | 5.84 | 9.92 | |

NOTE: 37 students completed this class, however, complete data was collected on only 33 students.

# ELECTRONIC MUSIC LITERACY

A RESEARCH PROJECT CONDUCTED BY
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## OVERVIEW

### Introduction/Background

The electronic age is altering many aspects of the field of music. In music education it is becoming increasingly important to implement new methods of instruction and competency in both computer-assisted instruction and in the use of synthesizers. It is a daunting task for those of us who went through pre-computer age doctoral programs in music. Some universities are now adding majors in Electronic Music and Music Technology. Meanwhile, those of us "out in the field" need to catch up.

### Problem

One of the most challenging teaching arenas for a musician is that of the general music class for "non-majors." Having devoted much time to development of pedagogy for teaching Music Appreciation classes, I have become convinced that use of up-to-date technology could be an important tool for teaching some very difficult concepts.

While I have been reasonably successful with retention, I often hear the statement, "This is my hardest class!" The challenges of dealing with a completely new vocabulary, and, most importantly, learning to listen critically, are very sophisticated learning tasks, not easily absorbed in one semester.

A Music Appreciation class requires a variety of methods of presentation to accommodate differing perceptions of what is being heard in the music. The limits in presentation are severe, since the instructor cannot rely on the standard of visual aid--the score.

## Purpose

This study proposes that students will benefit from the instructor's ability to draw upon new technology in computer-assisted instruction. My purpose in participating in this project was to learn some of this technology and apply it to use in a classroom presentation.

## Investigation

Issues under consideration in this study are: 1) does Irvine Valley College have the necessary resources in equipment and funds to support use of new technology in a music class? 2) as a novice in the computer world, what is required for me to gain adequate knowledge to use these technologies in the classroom? 3) does the use of computer-assisted instruction enhance the classroom learning environment, or is it a gimmick that cannot honestly replace a well-presented traditional lecture? 4) is electronic music literacy worth the time and immense commitment music teachers must make to being both musicians and teachers?

## Assumption

The assumption of this study is, yes; electronic music literacy is worth the effort and time required away from other activities for a music instructor at IVC. Students will develop curiosity and interest in use of new technologies. Further, the materials available will allow clearer presentation of complex musical concepts, thus enhancing learning.

## Explanation

The concept of musical texture is one of the most difficult for students to grasp. Knowledge of this concept is a keystone for understanding the development of Western music, so it cannot be slighted in Music Appreciation classes.

Music software has recently become available which allows playback of separate voices in a composition, in any selected segment, at any tempo, and in any combination of voices programmed.

## Scope

My preparation took place over a period of five months, beginning in January, 1989. I enrolled in two classes through the University of California at Irvine Extension Office. The two classes, Introduction to Electronic Music and MIDI Fundamentals, each met one night a week for three hours during the ten-week Winter quarter.

Students were introduced to the history of the synthesizer and learned the basic electronics involved in analog, digital, and sampled synthesis. In the MIDI classes students were assigned lab time in the UC Irvine Gassman Electronics Music Lab. Students learned the use of the synthesizer and the keyboard controller, and became acquainted with the rudiments of the software programs Performer and Professional Composer by Mark of the Unicorn. IVC was able to purchase these two programs for use in the present study. These programs will now be available for general use by music faculty, and eventually for student use. Using newly acquired skills, I developed a lesson on musical texture for presentation to a general education level music class.

# METHODOLOGY

## Design

The instructional format was designed for use in a class of fifty students. I chose to focus the discussion of musical texture in the following manner: 1) by limiting vocabulary to two concepts, polyphony and homophony, and 2) by limiting the range of instruments to one genre, keyboards. Choices among keyboards included piano, organ, harpsichord and synthesizer.

## Populations

The class, History of Rock, was apprised of the project in advance. At that time they were given a brief introduction to the meaning of the terms homophony and polyphony. (In simplest terms, homophony is described as a single melody with chordal accompaniment, and polyphony as having more than one melody.)

The entire class participated in the project. They were randomly divided in half, one group as the experimental group and the other half as the control group, receiving a traditional lecture on musical texture.

Instruments

A test was prepared collecting musical excerpts from various styles in music, Baroque through Romantic periods. These were recorded onto a cassette tape. The test items included excerpts from the following works:

1) Two-Part Invention in B-Flat, by J. S. Bach, as recorded by Walter Carlos on the album **Switched On Bach** (synthesizer)

2) Etude in A Minor, Opus 25, No. 11 (The "Revolutionary") by Frederic Chopin (piano)

3) Piano Sonata No. 31 in A-Flat by Ludwig von Beethoven

4) Fugue in G Minor (The "Little") by J. S. Bach (organ)

5) Nocturne in A Major, No. 8 by Field (piano)

6) Brandenburg Concerto No. 3 in G Major by J. S. Bach (synthesizer)

Two thirty-minute lessons on musical texture were prepared; one, a standard presentation similar to my usual introduction to the concept was delivered to the control group, and the other, a presentation using the software program Performer, was delivered to the experimental group.

Procedure

At the beginning of the presentation I gave a brief five-minute review of the terms "polyphony" and "homophony." The entire class then took a listening test, writing down "P" for polyphony or "H" for homophony. It was necessary to point out that almost all music displays some elements of both textures, but that the class was to indicate the predominant texture of each excerpt.

After the test was administered, I took the experimental group to the electronic music laboratory in Room A308. The set-up for the experimental group included the Yamaha PF 80 Master Keyboard Controller, a Macintosh II PC with external drive, MIDI cables to interface between the computer and the keyboard controller, and the software program Performer.

I presented two pieces which had been programmed into the computer using Performer: the Two Part Invention in C Major by J. S. Bach, which I played back using the harpischord mode, and Chopin's Nocturne in E-Flat, played using the piano mode. The students listened to the entire piece, followed by portions of the right and left hand voices of each piece. They discussed what they had heard, with no immediate consensus on texture.

As the students listened to the separate voices of each piece, and as we further defined "melody" (successive tones) and "harmony" (simultaneous tones, or chords), they came to agree that the Bach Invention clearly had separate melodies of integrity. Upon hearing the left and right hands of the Chopin Nocturne separately, the students were able to determine that the left hand did not constitute a melody unto itself, that it was accompanimental and chordal in nature.

The control group remained in Room A311, where I presented a thirty-minute traditional lesson, playing recordings of the same two pieces used with the experimental group. I attempted to transmit the same verbal information. The major limiting factor was the inability to hear right and left hands alone on the two pieces.

Following the second presentation, I administered a second listening test to both the experimental and control groups using the same list of pieces presented during the pre test. This concluded the presentation.

## Collection

Data collection was a simple matter of grading all of the pre tests and posts tests and aligning the results to set up a comparison between the two groups.

## Processing

The statistical analysis compares the experimental group who received the computer-assisted instruction with the control group who received a traditional lesson in musical texture.

## Limitations

Since students are human beings, each with his own set of variables, this type of experiment is very difficult to control, especially when there is no grade involved. If a student was late for either test, their results became invalid. Ideally, the experimental environment should be tightly controlled to gain maximum results.

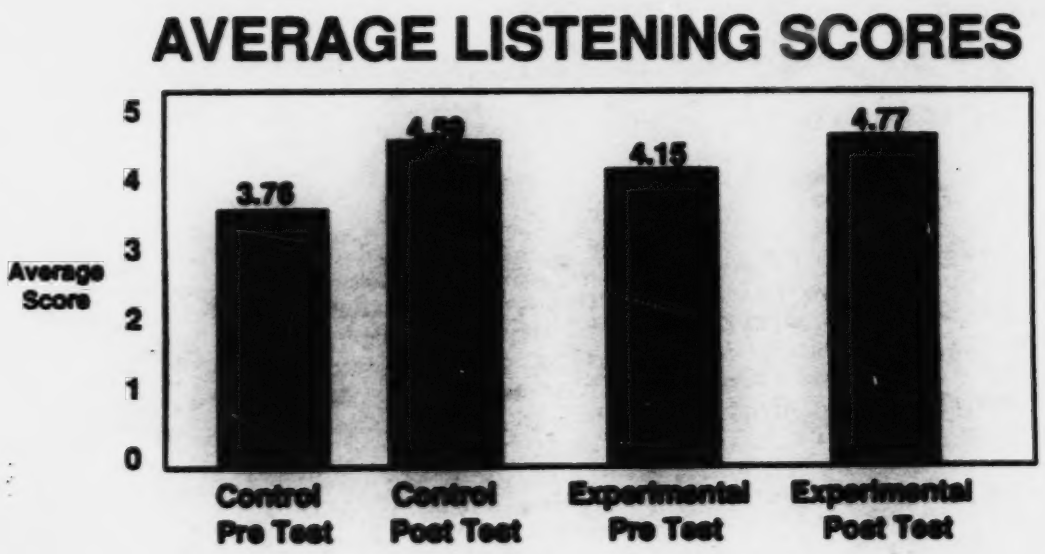
I am a novice with computer-assisted instruction, so this created time-consuming delays. There was a tremendous amount of material to assimilate before I could formulate a plan for classroom use. The result of this delay was a smaller number of valid tests.

FINDINGS

Factual Information

Several t-tests for the difference between group means were computed. The t-test for independence between pre test scores for the control and experimental groups was not significant (t=.547, 28 d.f.; p=0.577), lending support to the assumption that the two groups were equivalent in listening ability. The pre to post test dependent groups t-test was significant for the control group (t=1.912, 16 d.f.; $p < 0.05$, significant 1-tail), but not significant for the experimental group (t= 0.912, 12 d.f., p = 0.383). The group means were 3.76 and 4.59 for the control group's pre and posts tests. The group means were 4.15 and 4.77 for the experimental group's pre and post tests. Figure 1 permits comparison of the various group means. Although the control was the only group which achieved a statistically significant increase between pre and post test measurements, the experimental group's pre test average was higher than the control group's pre test average (4.15 experimental group to 3.76 for the control group). Yet the highest post test average was obtained by the experimental group (4.76 to 4.59).

FIGURE 1



Interpretation

These data support the notion that computer aided instruction can be an effective alternative or supplement to lecture presentations for teaching music listening skills. It isn't known if the computer aided presentation would have helped the control group achieve an even greater gain over their pre test scores. But the data analysis does show that the initially higher scoring group, the experimental group, achieved the highest post test average. Further testing with additional, and possibly larger, classes is needed. In addition, it would be interesting for a future study to evaluate the benefits of combining lecture and computer aided instruction for teaching difficult musical concepts.

## SUMMARY

The electronic age brings musician/teachers many new opportunities for expanding our avenues of musical expression, as well as our modes of teaching and learning about music. New programs are being written for use with the Macintosh PC that allow an instructor to either record in real time, or step-record a piece of music, so that the individual voice parts can be isolated and played separately. This provides for more clarity in exploring such elements of music as texture, dynamics, orchestration, and tonality.

The teaching methods employed in this study are being used by a growing number of instructors. Yet, each of us at some point has had to make the commitment toward computer and synthesizer literacy. We are then able to design lessons appropriate for our classroom needs.

The Classroom Based Research Project has allowed me the opportunity and incentive to become familiar with the new software and hardware involved with music synthesis. In addition, I was able to research the effectiveness of an instructional method that was new to me. The research involved a general music class, divided into an experimental group and a control group. A lesson was presented, using computer-assisted instruction for the experimental group and a traditional lesson for the control group. The subject, Musical Texture, is a difficult one for general students. The research, though somewhat inconclusive, seems to indicate positive response to computer-assisted instruction.

## Conclusions

The study seems to support the idea that computer-assisted instruction can be a useful tool in teaching complex musical concepts such as texture (polyphonic and homophonic). Further, it seems fair to conclude that an instructor's interest in researching effectiveness of a learning tool, and that an instructor's willingness to learn a new method would add to the classroom learning environment.

Students who detect sincerity and dedication to teaching are bound to respond favorably and be more highly motivated to learn. Perhaps some classroom based research project might be devised to correlate instructor involvement with the teaching process and students' ability to learn.

## Recommendations

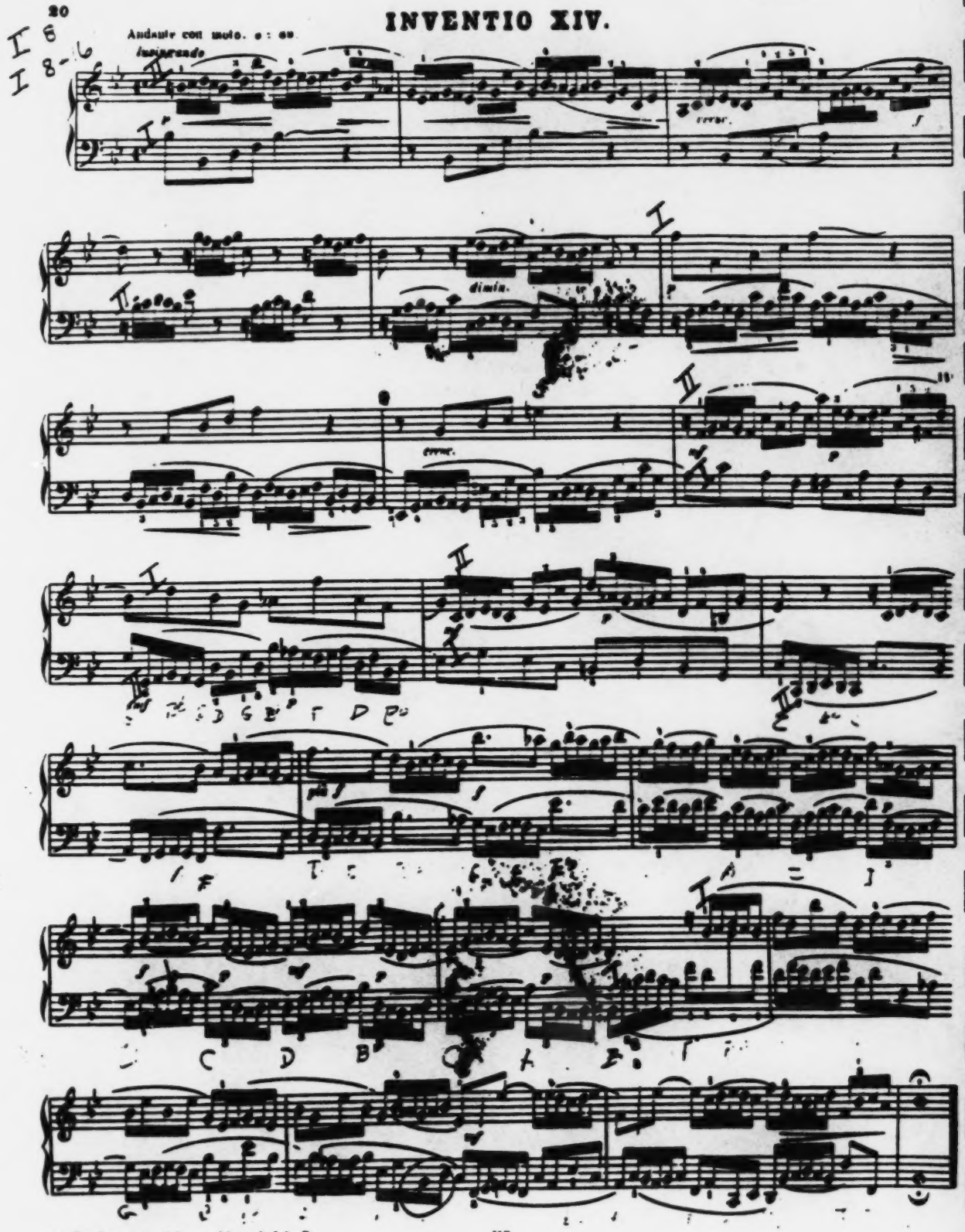
I strongly recommend further research and development of computer-assisted instruction in the general music classroom. A larger sample and a broader range of music classes, such as piano and voice classes, might provide useful additional data. The experiment could be enlarged to include the Professional Composer program, which I was unable to tackle in the time available this semester. This program could add the visual element. Students could see the musical lines in traditional notation on a large screen, in the same configuration as they are being heard, both individually and in combination. This visual aspect could be very beneficial both for students who already read music and for those who do not have the background to understand the correlation between the printed music and what they hear.

It is my hope that the music faculty of Irvine Valley College will take advantage of a) the equipment which is so easily available at the college, b) the newly purchased software programs, Performer and Professional Composer, and c) the friendly assistance of our business faculty in learning how to operate the computers.

Research Faculty Comments

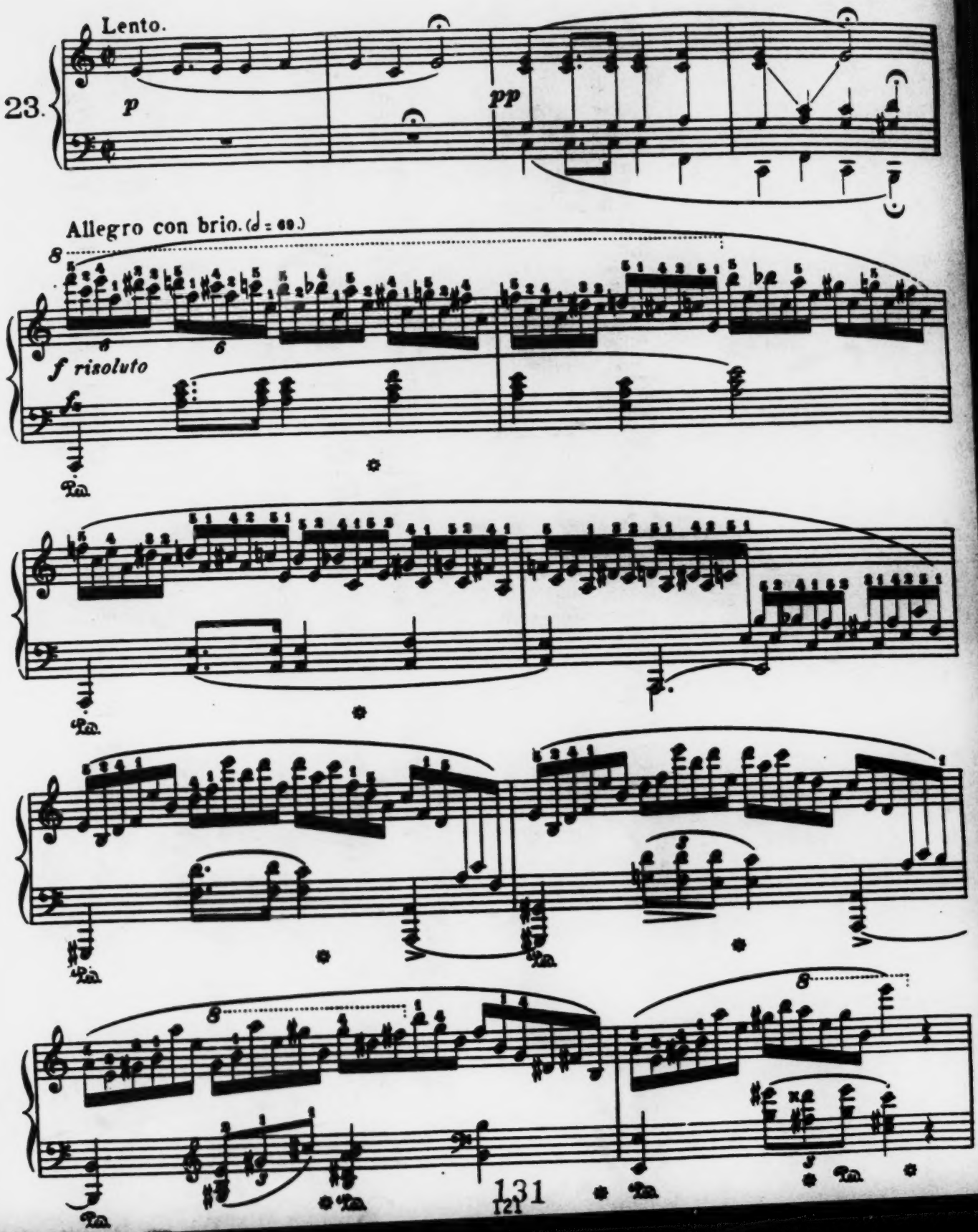
With such a limited background in the research and testing of human subjects, I could certainly have used a bit of training in how to set up the experiment, and how to avoid pitfalls in organizing the experiment. This is not to say that type of assistance was not available--Jerry Rudmann was most helpful. I just didn't know what questions to ask him this time around.

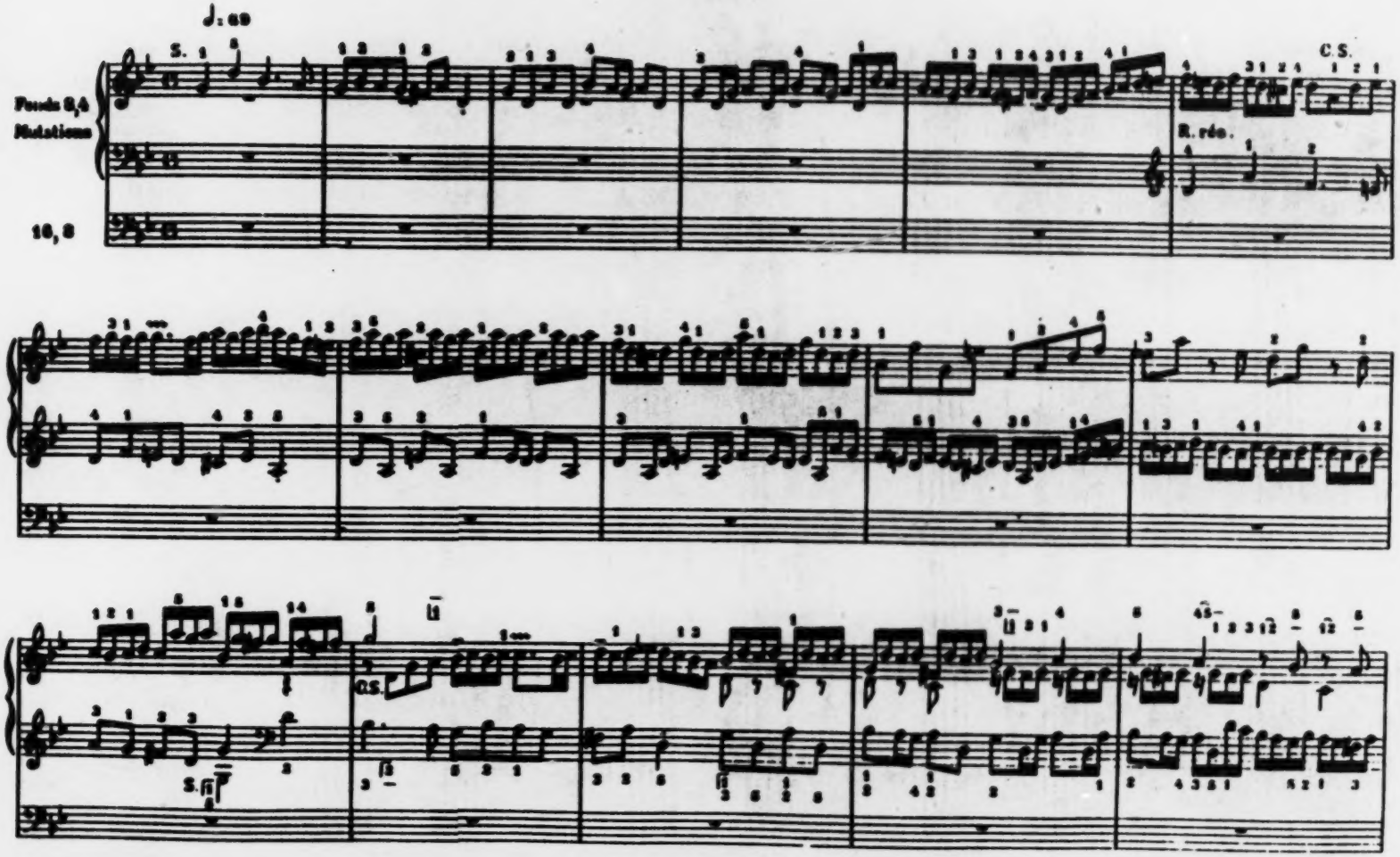
I appreciated the assistance of both Jerry Rudmann and Jan Horn in carrying out the project, and I believe firmly in the concept of classroom based research. I feel very strongly that this type of project should be widely encouraged at Irvine Valley College. We are too busy with committees and college administration and not busy enough with our students and their learning process.

# INVENTIO XIV.

14) The first autograph has an *A* instead of the *D*.

# Étude.

Test 2

F. CHOPIN. Op. 25, № 11.

# XII

## FUGA

Paris, S. BORNEMANN, Editeur
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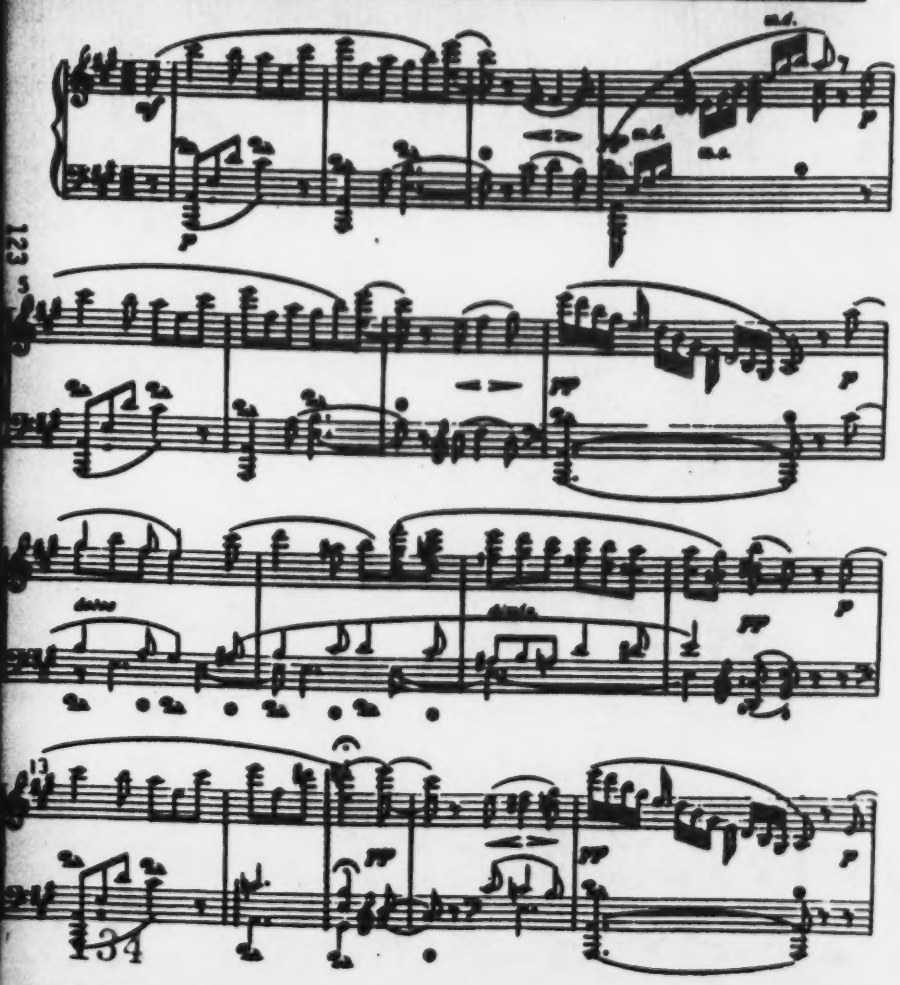
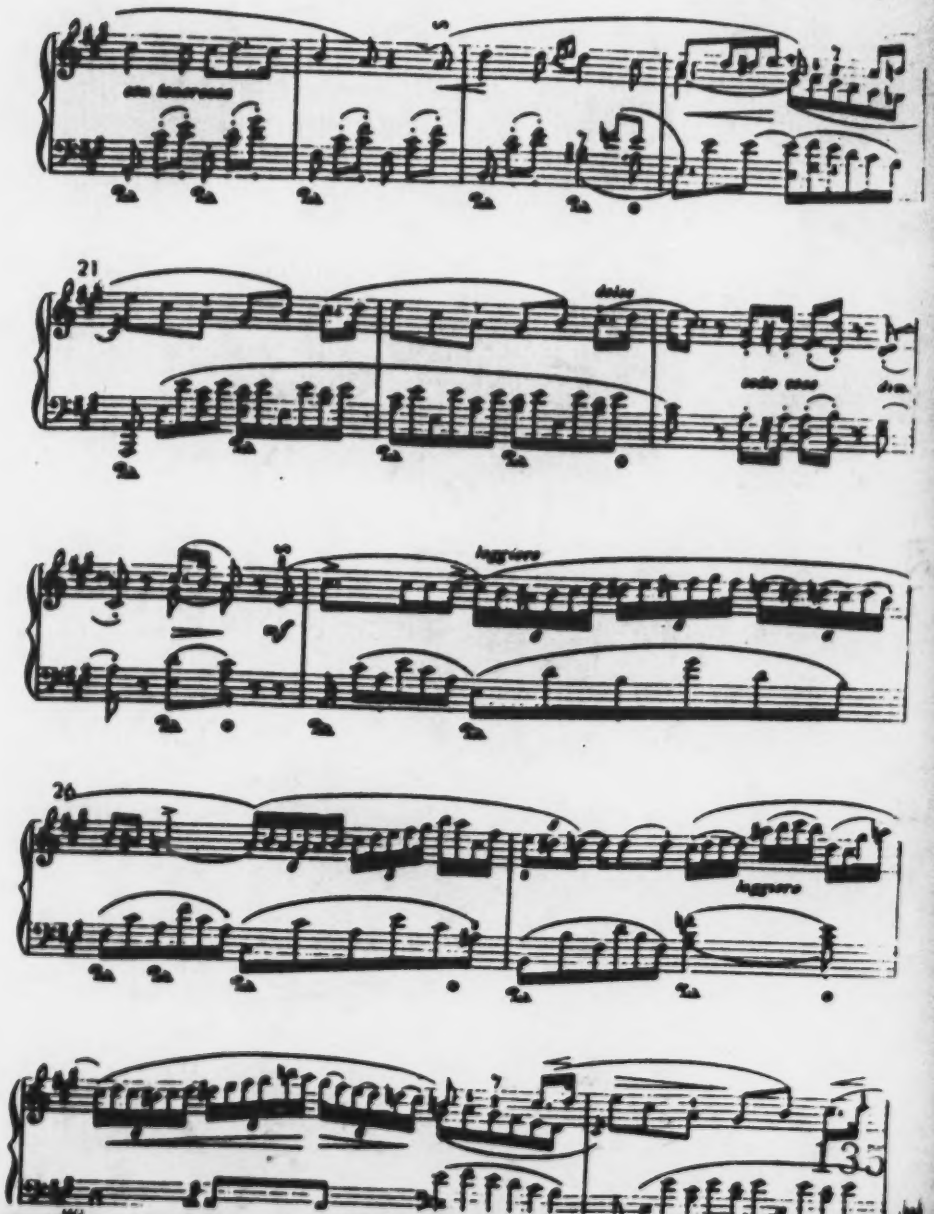
Irish

**John Field** (1782–1837)

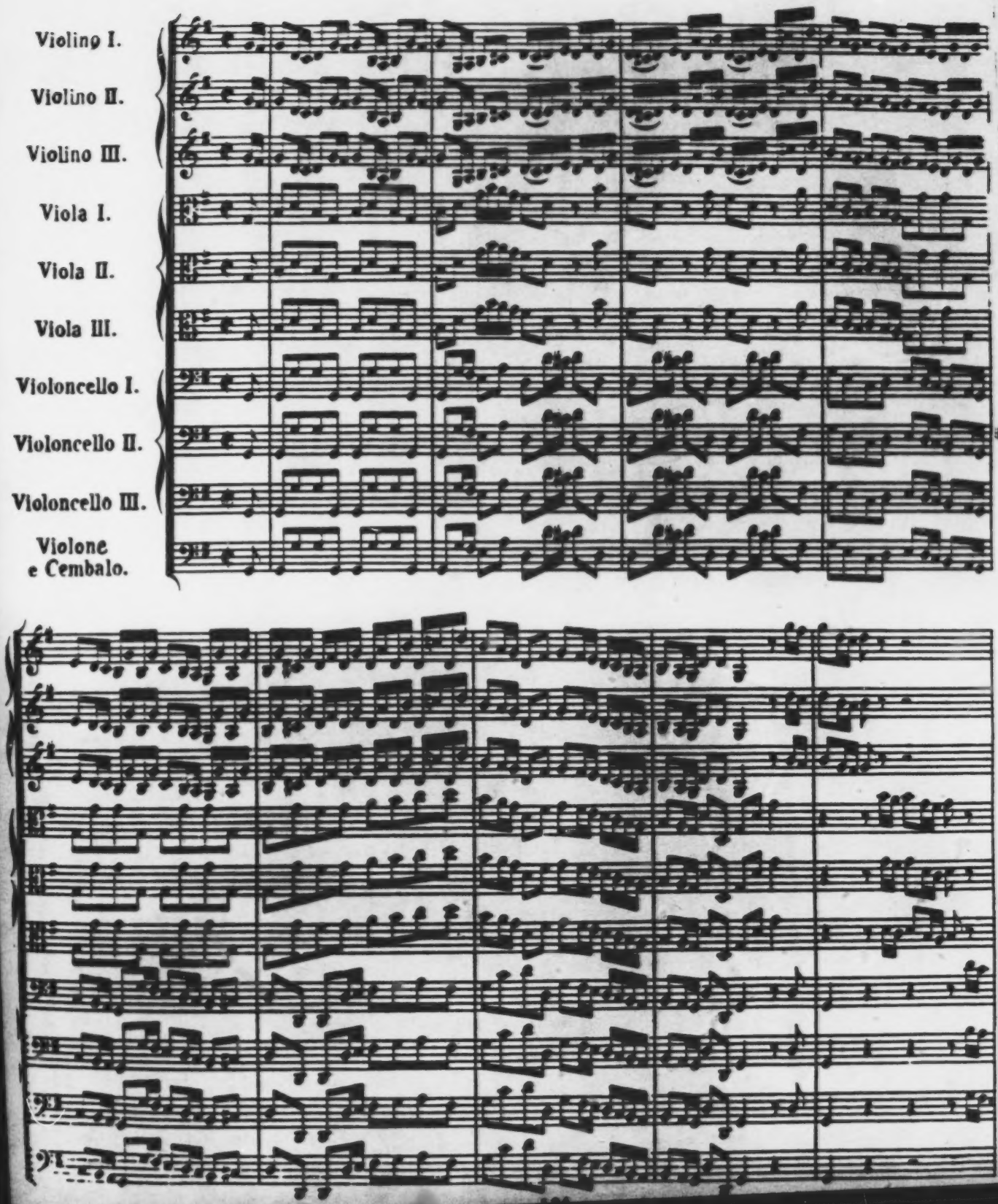
***Nocturne in A Major*, No. 8** (1811–15)

Chopin-ist nocturne dem 6ten Ais

**121**

This composition was first published in a longer version (96 measures) as a Passerale in the *Second Divertimento for Piano*

Test 6

# Brandenburg Concerto No. 3 in G Major



# DUNHAM DANCE TECHNIQUE TO IMPROVE STUDENT PREPAREDNESS FOR DANCE

A RESEARCH PROJECT CONDUCTED BY
SHIRLEY BROWN
PHYSICAL EDUCATION DIVISION
SACRAMENTO CITY COLLEGE
SPRING SEMESTER 1989

## OVERVIEW

### Description

The purpose of this project is to show the validity of the Kathryn Dunham dance technique as a basic dance form for other styles of dance.

A. Ethnic
B. Jazz
C. Modern

The Dunham barre technique was derived from dances of African and Haitian descent. There are ten different movements geared toward warming the body up and strengthening the arms and legs.

Dunham Barre Technique

1. Pushing body in and out
2. Waist bends
3. Drop and recover
4. Leg extensions
5. Lunges
6. Leg swings side to side
7. Second position plies
8. Leg swings forward and back
9. Second position foot releves
10. Jump lunges

It also creates more flexibility in the feet. From this type of technique, a student will gain more agility and coordination. The Dunham barre technique should prove to be more beneficial than a regular off the barre floor technique.

With my two jazz dance classes, I plan to teach one class the Dunham barre technique, and the other class will continue with the regular modern floor technique. From working on both techniques, I will teach the same dance pattern (routine) to both classes to illustrate the effectiveness of the Dunham technique and its influence on other dance forms.

METHODOLOGY

Procedure

During the spring semester 1989, both jazz dance classes learned the basic jazz dance technique. the Monday, Wednesday, Friday dance class continued with the regular modern jazz dance technique, while the Tuesday, Thursday dance class during the entire month of May learned and executed the Dunham technique. Both classes also learned a dance pattern (routine) which was to determine the validity of the Dunham Technique.

The Tuesday, Thursday class was taught the following twelve barre technique movements:

1. Pushing body in and out - Standing arms length from the barre with feet shoulder length apart, holding onto the barre, the student pushes the body forward and back while bending arms when going forward and keeping the feet flat on the floor.

2. Waist bends - Standing with the feet in medium second position while holding onto the barre with arms straight, the student bends over to the waist keeping the back flat and spreading the hands further apart as she bends forward and hands come back to original position as student raises up.

3. Drop and Recover - Starting in medium second position, facing the barre arms distance, student starts bent over to the waist with a flat back, arms are straight while hands are holding onto the barre. Student releases hands from the barre while dropping body down, so the chest goes toward the thighs and the back is slightly rounded. From there, student raises body back up and returns to starting position.

4. Leg Extensions - Standing in a modern first position with back to the bar, holding on. Lift leg up to waist bent on first four counts, toes are pointed. On 5, straighten leg out, on 6 flex foot, on 7 and 8, lower leg down to the floor. Repeat, two sets on each leg.

5. Lunges - Facing the bar standing in a modern first, extend the right foot back with heel off the floor. Every time opposite knee bends, the heel touches the floor. Student does seven on one side with transition on eight, ready to do on the other side.

6. Leg Swings Side to Side - Standing in a modern first with back to bar and holding on to it. Lift the right leg up bent across standing leg and toes pointed, bring leg down and flex foot when it touches the floor. Repeat same movement as leg goes out to the side. Do sequence four times on each side.

7. Second Position Plies - Facing the far with feet in second position and holding onto the bar. Bend the knees for four counts, lift right heel and bend for four counts. Repeat on left side, then lift both heels off floor at the same time while bending knees. Repeat entire sequence from the beginning several times.

8. Leg Swings Forward and Back - Facing bar with feet in a modern first and hold onto bar arms length. Lift leg up bent forward bring leg down as you flex foot. Lift leg back as you bend it. Repeat four sets on each leg. Standing leg remains straight.

9. Second Position Foot Releves - Facing the bar with feet in second position and holding onto the bar. Lift right heel up four times, repeat on left side, then do both heels together four times.

10. Jump Lunges - Standing in first position away from bar, with back to bar and arms to side. Jump with right foot going back as left foot goes forward. Every time you land the leg in front will be bent. Jump 7 times, turn on the count of eight. Repeat.

Students in both classes were given one month to learn and perform the dance pattern to the best of their ability. Everyone was broken up into groups of six, seven, or eight and were given ample time to practice with each other.

The dance pattern had isolative and two different locomotor movements. Everyone danced to a medium tempo popular style jazz music.

Both dance classes were videotaped in groups of six or eight. They both presented the same dance pattern. The composition and production dance class evaluated both dance classes, however they did not know one class from another because the tapes were mixed up. There were a total of eight tapes. The evaluators were given the following form:

EVALUATION FORM FOR DANCE PROJECT

0 1 2 3 4 5 6 7 8 9
Poor Average Good

1. Rhythm - Was the student group dancing to the beat of the music or against it?

0 1 2 3 4 5 6 7 8 9

2. Coordination/Transitions - Was the student group moving from one series of movements to the next correctly?

0 1 2 3 4 5 6 7 8 9

3. Showmanship and Stage Presence - Was the student group projecting?

0 1 2 3 4 5 6 7 8 9

4. Proper execution of dance routine to the best of student's ability - Were arms, legs, feet, and body moving properly in the correct formations?

0 1 2 3 4 5 6 7 8 9

FINDINGS

For the following calculations:

Population 1 is the population of students that train with the Dunham Technique.

Population 2 is the population of students that train with the Modern Jazz Technique.

For each of the four tests, the following $H_o$ and $H_a$ will be used:

$H_o: \mu_1 - \mu_2 = 0$ There is no difference in the mean scores of the two populations on each criteria compared.

$H_a: \mu_1 - \mu_2 > 0$ The mean score of the students that train with the Dunham Technique is greater than the mean score of the students that train with the Modern Jazz Technique.

For each of the four tests, the following test statistic will be used:

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$\bar{x}_1$ is the mean of the sample from Population 1.

$\bar{x}_2$ is the mean of the sample from Population 2.

$s_1^2$ is the variance of the sample data from Population .

$s_2^2$ is the variance of the sample data from Population 2.

For each of the four tests, a 5% level of significance will be used. Therefore:

if $Z > z_a$ (=1.65), then reject $H_o$.
if $Z < z_a$ (=1.65), then do not reject $H_o$.

Test 1. Comparing the Rhythm Scores

For the $n_1 = 40$ and $n_2 = 40$ data points:

$\bar{x}_1 = 5.90$ $\bar{x}_2 = 6.45$

$s_1^2 = 3.68$ $s_2^2 = 1.90$

$$Z = \frac{5.90 - 6.45}{\sqrt{\frac{3.68}{40} + \frac{1.90}{40}}} = -1.47$$

Since $-1.47 < 1.65$, do not reject $H_0$. The Dunham Technique does not show a greater mean score on Rhythm over the Modern Jazz Technique.

Test 2. Comparing the Coordination Scores

For the $n_1 = 40$ and $n_2 = 40$ data points:

$\bar{x}_1 = 5.50$ $\bar{x}_2 = 6.20$

$s_1^2 = 4.00$ $s_2^2 = 1.81$

$$Z = \frac{5.50 - 6.25}{\sqrt{\frac{4.00}{40} + \frac{1.81}{40}}} = -1.84$$

Since $-1.84 < 1.65$, do not reject $H_0$. The Dunham Technique does not show a greater mean score on Coordination over the Modern Jazz Technique.

Test 3. Comparing the Showmanship Scores

For the $n_1 = 40$ and $n_2 = 40$ data points:

$\bar{x}_1 = 5.58$ $\bar{x}_2 = 5.68$

$s_1^2 = 3.74$ $s_2^2 = 2.23$

$$Z = \frac{5.58 - 5.68}{\sqrt{\frac{3.74}{40} + \frac{2.23}{40}}} = -0.26$$

Since $-0.26 < 1.65$, do not reject $H_o$. The Dunham Technique does not show a greater mean score on Showmanship over the Modern Jazz Technique.

Test 4. Comparing the Proper Execution Scores

For the $n_1 = 40$ and $n_2 = 40$ data points:

$\bar{x}_1 = 4.90$ $\bar{x}_2 = 6.18$

$s_1^2 = 4.04$ $s_2^2 = 1.79$

$$Z = \frac{4.90 - 6.18}{\sqrt{\frac{4.04}{40} + \frac{1.79}{40}}} = -3.35$$

Since $-3.35 < 1.65$, do not reject $H_o$. The Dunham Technique does not show a greater mean score on Proper Execution over the Modern Jazz Technique.

SUMMARY

1. Rhythm - Students who learned the Dunham technique scored average to poor in this area.

2. Coordination/Transitions - Students who learned the Dunham technique scored average to poor in this area.

3. Showmanship and Stage Presence - Students who learned the Dunham technique scored average to poor in this area.

4. Proper Execution of Dance Routine to the Best of Student's Ability - Students who learned the Dunham technique scored average to poor in this area.

The data analysis showed the students who learned the Dunham technique were not at an advantage and were not able to perform the dance pattern with more skill and ability. Both classes did learn and practice the basic modern jazz dance technique for three months, then the fourth month was when the Tuesday, Thursday class learned the Dunham technique. The Monday, Wednesday, Friday class continued with the jazz technique, which gave them more confidence and ability to perform the dance pattern.

After having taught the Dunham Technique, I realized the students were not given enough time. They should have been taught this technique at the very beginning of the semester, instead of one month. There was an imbalance in this area which affected the final outcome.

Conclusion

This dance project proved to be very beneficial to the students who participated and to myself. Even with the data analysis which rated the Dunham technique group average to poor, I feel with more or equal time allotted, the data would have been better.

The Dunham Technique was different from the jazz technique, but was also somewhat similar. It was a technique with many variations and if given more time, we could have developed it even more.

I am not disappointed with the results because it was a very exciting research project, and I would like to do it again with more time permitted.

Limitations

1. The class learning the Dunham technique should have had more time to develop the technique (two months instead of one).

2. The students who learned the Dunham Technique were not as skilled as the other group.

3. Even though the Tuesday, Thursday class learning the Dunham Technique met twice a week, I feel they should have met three times a week as did the Monday, Wednesday, Friday jazz dance class.

# A COMPARISON OF TWO DIFFERENT METHODS OF MOTIVATING STUDENTS TO IMPROVE THEIR PHYSICAL FITNESS LEVELS

A RESEARCH PROJECT CONDUCTED BY
PAM DEEGAN
SCHOOL OF HEALTH, LIFE & EARTH SCIENCES
IRVINE VALLEY COLLEGE
SPRING SEMESTER 1989

## OVERVIEW

### Introduction

A majority of the students who enroll in the cardiovascular fitness courses do so in an attempt to lose body fat. Although all of them undergo the same exercise regime and receive the same lecture information, some lose substantial amounts of fat while others do not. It may be that a key factor in this issue is the level of motivation with which students approach their extra-curricular lifestyle habits. These habits, which include exercise patterns and dietary practices, impact the final fitness level of students enrolled in physical education classes.

### Background

The problem of why certain students attain their fitness goals and others do not poses a serious question in a cardiorespiratory fitness course - one which requires continual investigation. When viewed from a curricular perspective, these courses list a number of objectives. One objective is that students gain an understanding of how exercise affects the physiological functioning of their bodies. A second objective is that students receive information regarding diet. A third objective is that students not only gain academic information regarding these issues, but additionally, integrate their newly gained information into a lifestyle change such that they achieve an improved state of physical fitness. This should occur by the end of the course. To not attain any one of these objectives indicates that either the method of instruction or other variables are inadequate in terms of attaining the course objectives.

## Problem

In order to achieve the desired fitness goals established by the course objectives, the instructor of each fitness class needs to explore various methods of enhancing the fitness level of their students. A major problem which hinders this fitness achievement is that a significant alteration in aerobic capacity and fat loss requires four to five days of cardiovascular conditioning. Presently, the fitness courses offered at Irvine Valley College meet only two days each week. Students are continually reminded that they need to augment their fitness classes with an additional two to three days of exercise. They are also instructed that they must adhere to the dietary principles discussed in class. This out-of-class adherence is a major concern to both students and instructors. Instructors have limited control of extracurricular behavior in this matter. Students often complain that without the structure of a classroom setting, they drift from their exercise and diet regimen due to a lack of motivation.

## Purpose

The problem under investigation in this study was the determination of which mode of motivation - a motivational buddy or a daily journal - had the greatest effect on fitness enhancement. This study was limited to an investigation of the following fitness factors: 1) body weight, 2) percentage body fat, 3) anthropometric measurements, and 4) exercise heart rate.

## Investigation

A comparison of these different motivational techniques will help fitness instructors determine whether one of these methods merits consideration in the instructional procedures presently used in the fitness courses. The assumption is that one of these techniques of motivation will have a greater impact on students than the other technique.

## Research Hypothesis

The following null-hypothesis was tested. When comparing motivational buddies with daily journals as methods of improving extracurricular fitness motivation, neither method would prove to be significantly better than the other.

## METHODOLOGY

### Design

Two beginning aerobics classes were used for investigation in this study. Both classes were told that twenty percent of their final course grade would be determined by a different parameter. The Monday/Wednesday class was told that they would be required to keep a daily journal of their exercise schedule as well as their daily caloric intake. The Tuesday/Thursday class was told that once a buddy was assigned to them they were responsible for motivating that person to continue to exercise and eat appropriately outside of the confines of the class.

### Populations

Each class had approximately 30 students in it. Although both classes were coed, both contained approximately ninety-eight percent females. All of the students entered the class with a beginning level of ability in terms of performing aerobic dance.

There was a wide fluctuation in age in both classes. The ages ranged from eighteen to fifty-six years old in the Monday/ Wednesday class with the mean age being twenty-seven and one-half years old. The Tuesday/Thursday group ranged in age from eighteen to forty-eight years old with a mean age of thirty-two and one-third years old. Both groups were comprised of healthy individuals as determined by a health questionnaire which was completed by each subject prior to the beginning of the class. The only exception was the Monday/Wednesday group which contained an individual who was undergoing chemotherapy for cancer for the duration of the study.

### Testing Procedures

Tests were administered to all subjects during the fourth week of classes. Data collected on each subject included: age, weight, anthropometric measurements, body fat, and exercise heart rate. During the final week of the course these parameters were measured again. For each measurement session students were measured by a partner, with the exception of body fat, which was measured by the course instructor. When appropriate, students were instructed to measure to the nearest eighth of an inch. They also were instructed to note the clothing which they wore for the pre-test such that the exact clothing could be worn once again for the post-test. Clothing was to be loose fitting shorts and T-shirt with aerobics shoes and socks. The measured variables listed above are described in the following sections.

Weight - the weight of each student was measured with a physicians scale to the nearest one-quarter pound.

Anthropometric Measurements - anthropometric measurements were taken as part of the pre-test and post-test. Students were instructed to measure both sides of their bodies when appropriate from a contracted position. Included were the following locations:

1) the maximal circumference of the biceps while flexed with a clenched fist;

2) the maximal circumference of the forearm with a flexed wrist;

3) the maximal circumference of the chest after an inhalation then exhalation;

4) the circumference parallel to the ground while on top of the iliac crests;

5) the largest circumference of the gluteal muscles;

6) the circumference of the thigh as determined by dividing the distance between the top of the patella and the crease evident when flexing the leg at the hip, and

7) the maximal circumference of the calf.

All measurements were taken from a standing position and were taken to the nearest eighth of an inch.

Body Fat - body fat was determined by using the Jackson-Pollack method of fat determination. Equipment included the Skyndex skinfold calipers which utilize a computer to immediately calculate body fat. Three sites were used for both men and women: triceps, iliac crest, and thigh for females; and axillary, umbilicus, and thigh for males. All measurements were taken on the right side. These measurements were taken by the instructor while the subject was in a standing position.

Exercise Heart Rate - a step test was administered to the subjects. A thirty-three centimeter high step bench was used for females while a forty centimeter high step bench was used for males. Students stepped up and down on the bench for a period of five minutes while a metronome established a beat of ninety-six beats per minute. After the five minutes students were given five seconds to sit down. A ten second pulse rate was then measured by each student. The timing was done by the same tester for each subject. Students were instructed to terminate the test if they experienced pain, breathlessness, chest pain, nausea, lightheadedness, or any other type of discomfort.

## Instructional Procedure

The instruction delivered to each class was the same. Each class began with a warm-up and then proceeded to an aerobic work-out. This was followed by a cool-down and isolated exercises. The duration of the aerobic exercise gradually increased by the same time frame for each class. Supplemental lecture materials and handouts were given in the same manner to each class.

Both groups were instructed to keep a diary. The Monday/ Wednesday group kept a journal of their daily exercise schedule. Included were length of exercise, type of exercise, and comments. This was supplemented with a list of all food eaten daily. These logs were submitted for review by the instructor twice during the semester.

The Tuesday/Thursday group was assigned a buddy. They were instructed to contact their buddy at least four times each week. They were to attempt to motivate their buddy to continue to exercise and eat appropriately. After a discussion with their buddies, the students were to enter their conversations in a journal. These journals were submitted to the instructor twice during the semester.

## Limitations of the Study

One limitation of the study was that many of the subjects failed to appear for the pre-test or post-test. They were therefore eliminated from the statistical analyses performed on the data collected. This left ten subjects in one group and eleven in the other. All remaining subjects were female.
A second limitation was that students and their partners performed the anthropometric measurements. Due to a high mortality rate, measurement partners often varied between pre-tests and post-tests, thereby diminishing consistency in data collection.

## Statistical Analysis

Only those students who completed both the pre-test, post-test, and record journals were analyzed in a statistical manner. This left ten students in the buddy group and eleven students in the daily journal group.

T-tests were performed on the data. A five percent level of confidence was adopted as an indicator of significance.

FINDINGS

Charts 1 and 2 summarize the data collected in the study. The numbers listed represent the difference between the means of the two test groups for each parameter measured.

Chart 1

DIFFERENCES IN MEANS WHEN COMPARING PRE- AND POST-TESTS

| | Weight | *Bicep | * Forearm | *Chest | *Waist |
|---|---|---|---|---|---|
| Buddy System | .80 | .19 | .01 | .23 | .39 |
| Daily Journal | .11 | .17 | .14 | .03 | .16 |

Chart 2

DIFFERENCES IN MEANS WHEN COMPARING PRE- AND POST-TESTS

| | Hips | Gluteus | *Thigh | *Calf | Body Fat | Steptest |
|---|---|---|---|---|---|---|
| Buddy System | .32 | .16 | .57 | .11 | 2.04 | 9.72 |
| Daily Journal | .16 | .57 | .48 | .16 | .25 | 2.40 |

* right side only

When weight and other anthropometric measurements were compared, there was not a significant difference between the two groups.

However, when comparing body fat and exercise heart rates there was a significant difference between the two groups. The group which utilized the buddy system had a greater reduction in body fat and exercise heart rates than the daily journal group.

T-tests for related measures found a significant reduction in body fat for the buddy system - $t(8) = 2.756$, $P=0.024$; and step test heartrate for the buddy system, $t(6) = 3.108$, $P=0.018$.

T-tests for related measures for the daily journal group found no significant improvement in heart rate and body fat. However, there was a slight reduction (0.22%) in body fat for the daily journal group.

An independent groups t-test comparing percentage body fat pre-tests means between the daily journal and buddy system groups was not significant. Neither were independent groups t-tests comparing percentage body fat post-tests means for the two treatment groups.

Similarly, there was no significant difference for buddy systems and daily journal pre-test means on the step test. The step test means (post-test) for the buddy system and daily journal groups were not significantly different.

Interpretation

It is common for body weight to remain stable due to aerobic exercise. Weight may actually increase due to the fact that exercise increases muscle mass thereby increasing weight. Changes in circumference often show subtle fluctuations but are influenced a great deal by genetic make-up.

Decreases in body fat as well as exercise heart rate should occur, however, with aerobic exercise. These changes occurred more significantly in the buddy group. Since all other variables such as exercise regime and instructional materials were the same, it can be assumed that having a motivational buddy was the variable which caused a reduction in body fat and heart rate. When comparing motivational buddies with daily journals as methods of improving extracurricular fitness motivation, motivational buddies proved to be better in reduction of body fat and exercise heart rate. Examination of figures 1 and 2 reveals the relative reduction in percent body fat and steptest heartrate for the two treatment groups.

SUMMARY

It would appear that using a buddy was a good method of augmenting the class in terms of achieving the course objective.

Recommendations

It is suggested that this study be replicated with attention paid to the study limitations. All students need to be assessed by the same individuals, thus assuring a greater degree of consistency. Secondly, attempts need to be made to decrease subject mortality. Thirdly, other motivational techniques such as monetary rewards, weekly reward programs, counseling, and others need to be investigated. In this manner, instructors and students alike will have a better understanding of what methods help students attain their fitness goals.

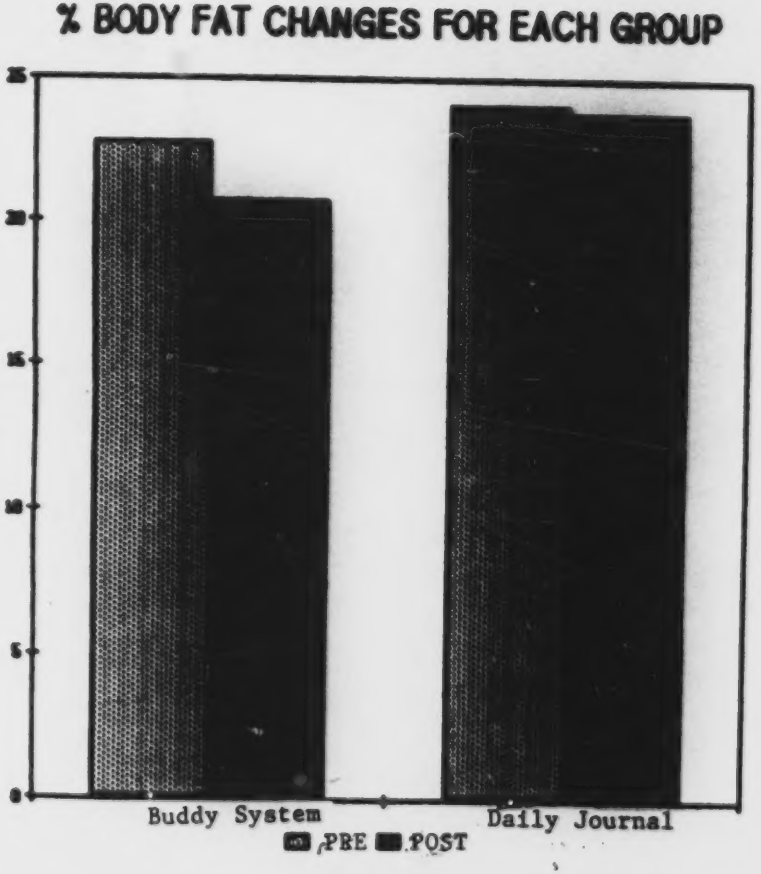



Figure 1.



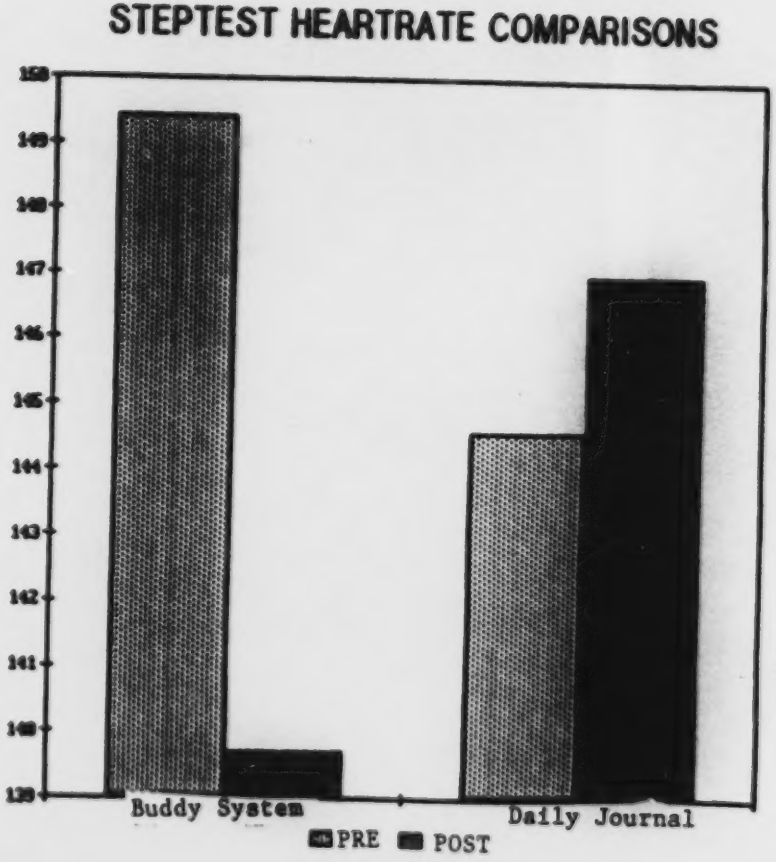



Figure 2.

# SELF-DEFINITION AS A FACTOR IN STUDENT SUCCESS

A RESEARCH PROJECT CONDUCTED BY
TONYA HILLIGOSS
SOCIAL SCIENCES DIVISION
SACRAMENTO CITY COLLEGE
SPRING SEMESTER 1989

## OVERVIEW

This project was designed to study the combined effects of a personalized teaching style with opportunities for group interaction. The purpose was to determine how these variables affect the experience of being a student. That experience varies dramatically between students who are successful and those who are not and this study was based on the assumption that self-definition is a product of external social forces as well as individual factors. The instructional question revolves around the ways in which that definition can be affected by what occurs in the classroom. College classrooms are sometimes alienating environments in which students spend an entire semester without ever interacting with anyone and although the dissemination of knowledge is not necessarily dependent on interaction, it may be enhanced by it. This study was designed to identify ways in which that can be accomplished.

A personalized teaching style is one in which the instructor aggressively interacts with students in a positive manner. One of the questions being addressed was whether or not this has an effect on student performance. The first basic assumption was that the way in which an individual defines him or herself as a student is critical to the academic success of that individual. The second assumption was that the alienation found in a typical large class contributes to the sense that learning is the responsibility of the instructor and that the integration of a personalized teaching style with opportunities for group interaction helps to counteract that feeling, thereby resulting in intensified opportunities for learning. It was hypothesized that students who work cooperatively to solve concrete problems will view those problems as challenges and will approach them as meaningful activities rather than pointless academic exercises. This was based on the assumption that the more democratic and participatory atmosphere engendered by a personalized teaching style would encourage students to feel more involved in the learning process and to accept the primary responsibility for their own education.

This study focused on two introductory sociology classes, one of which was taught in a traditional style while the other was taught in a manner designed to create a sense of community among the students and the instructor. An effort was made to induce a feeling of commitment to both the material and to one another in the experimental group. The hypothesis underlying this project was that students who experience a sense of community with their instructors and their classmates will have less anxiety, higher levels of self-confidence and greater commitment to learning the subject matter, thereby defining their role as students in a more positive manner.

Previous studies conducted by Robert T. Carroll and Delbert L. Prescott[1] indicated that the introduction of skills components into classes failed to produce significant differences in the performance and retention levels of students. However, when Prescott introduced the personalized teaching strategy of calling absent students, he was convinced that it prevented drop rates from rising even higher. A strictly qualitative study conducted by Barbara Davis[2] relied exclusively on personalized teaching strategies and group activities which were designed to "strengthen the interpersonal connections in the classroom."[3] Davis was convinced that these strategies increased the rate of retention. Although this perception was not statistically tested, her conclusions are consistent with the findings described below.

METHODOLOGY

Descriptive Data

The two introductory sociology classes which were compared were taught on the same days in the same room by the same instructor. The control group met at 9:00 a.m. three days a week and the material was presented in a traditional lecture format. Discussion was encouraged but there were no exercises designed to promote it. The experimental group met at 10:00 a.m. and the class was taught in a highly personalized manner with specific exercises designed to encourage interaction. A letter* was sent to all pre-enrolled students in the experimental group welcoming them to the class and providing an indication of the instructor's philosophical approach to the course.

* Refer to Appendix A

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[1] Wiecking, Kirk M. and Gene Sellers, Classroom Based Research Report, June 1988.

[2] Wiecking, Kirk M. and Marguerite J. Jones, Classroom Based Research Report, June 1987.

[3] Ibid., p. 31

That set the stage for a student-initiated discussion the first day of class which suggested that this was to be a unique experience. Without any effort beyond that of sending the letter, the process of defining what the class was about and establishing a sense of being part of something special arose out of the experience of receiving
that letter. This was followed by two class sessions devoted to dyadic introductions. Students were paired with other students they did not previously know, they interviewed those students in accordance with some basic guidelines and they then introduced them to the rest of the class. The instructor participated in this activity, emphasizing that education is a reciprocal process and encouraging the continued participation of students throughout the semester.

From the very beginning, a conscious attempt was made to help students in the experimental group define their role in class as an active one. Students in this group were contacted by telephone when they missed classes and were reminded about upcoming quizzes which were given each week. Although they were never asked why they missed class, several volunteered that information and even more expressed gratitude for the phone call and the interest which they felt those calls represented. Another example of a personalized teaching strategy was that complimentary or encouraging comments regarding the progress of individual students were noted on the quizzes which were returned to them each week.

Two measures were used to determine whether or not the students in both classes were comparable at the beginning of the semester. It was assumed that self-esteem plays a part in determining student success so each student completed the adult form of the Coopersmith Inventory at both the beginning and the end of the semester. The hope was that a highly interactive learning experience would help raise self-esteem scores. The average score of the control group increased 3.1 points whereas that of the experimental group increased 4.5 points. Those differences are not statistically significant, but it is interesting to note that the average score of the control group was five points higher than that of the experimental group at the beginning of the semester. The second measure was that of cumulative grade point averages through the Fall 1988 semester. It was assumed that similar GPA's would be an indicator of comparable academic ability. Through the Fall 1988 semester, the control group had an average cumulative GPA of 2.54 compared to an average of 2.57 for the experimental group, indicating that the groups were definitely comparable. There was also a qualitative survey instrument+ which was administered at the end of the semester. It was designed to evaluate student experiences which could not be measured any other way.

+Refer to Appendix B

Students in both classes were responsible for mastering the same material and they were all given eleven quizzes (although only the eight highest scores counted), three midterms and one final examination. In addition, they all had the option of completing pre-approved extra credit assignments. The only identifiable variable which differed was the way in which the classes were taught. The control group was lectured to although questions were welcomed and sometimes developed into class discussions. The experimental group was also lectured to but opportunities for direct student interaction were intentionally created and deliberate efforts were made to encourage interaction between students and the instructor. These took the form of the instructor remaining in the classroom so that there was the opportunity for pre-class discussions with early arrivals to the 10:00 class. I also remained after class to answer questions and continue discussing issues which had arisen in class. Since another class followed ours, this often meant continuing these discussions in the hall and elsewhere but students stayed to talk anyway. Although remaining in the room between classes also meant that I was available to students in the 9:00 class, fewer students in that group took advantage of the opportunity and even those who did tended to ask quick questions and then leave without the extended discussions engaged in by students in the 10:00 class. Also, 10:00 students often sought advice about personal and academic matters unrelated to the class, a phenomenon which rarely occurred among students in the 9:00 class.

The most easily defined difference in the way the two classes were taught is that the experimental group had the opportunity to participate in interactive group experiences in which they could get to know one another. Although there were a limited number of these, they began at the start of the semester and the members of these groups changed so that students had the opportunity to meet most of the people in the class. The dyadic introductions at the beginning of the semester functioned to reduce the isolation often experienced in large lecture classes. Even students who did not interview one another felt that they knew something about each other because detailed introductions were made to the entire class. They also helped break through the reluctance to participate because each individual was required to speak to the class at the very beginning. Because what they said was structured and focused on another person, there was little visible discomfort with this process. In fact, several students expressed their pleasure with it.

Other interactive exercises included one about popular culture in which students were divided into groups, given advertisements from magazines and current lists of the most popular movies, books, songs, etc. and asked to use those materials to identify contemporary social values.

Each group worked together to compile a list of values which was transferred to the blackboard so that they could be compared with one another and with a list prepared by social researchers. The purpose was to teach them how to help one another apply basic sociological theory to the world around them. Several students initially had trouble integrating theoretical concepts with concrete elements of social life but they were able to work through that problem by tackling it as a group.

Another exercise was in conjunction with our discussion of sexuality as a social issue. Students were divided into groups and asked to consider the role of sex-related issues in society from a macrosociological perspective. There had been a great deal of media coverage of the abortion controversy, and I wanted them to learn to view personal behavior in broader social terms so that they could better understand how issues which appear to be personal can divide the nation. Specifically, they were asked to imagine that they were in charge of a newly-created country and to determine how they would regulate sexual behavior. They were then told to consider the consequences of their decisions and be prepared to discuss them with the class. The results differed in predictable ways, but even students with strong opinions on particular sexual issues were forced to conclude that personal matters do have social consequences. This was then related to our discussion of Durkheim and his study of suicide so that they could begin to see the connection between theory and everyday social life.

A third exercise integrated our discussion of the family with the broader theoretical concept of rationalization and revolved around the decision about whether or not to have children. The class was divided into combined groups of men and women who were asked to consider the pros and cons of parenthood and then make a rational choice regarding whether or not to have children. Students had the opportunity to collectively experience the conflict of having to resolve an issue in which personal convictions cannot always be defended rationally. The class discussion which followed helped them transfer that experience to the related global issue of overpopulation as well as to other issues, such as nuclear armament, in which emotion cannot always be reconciled with reason.

These exercises were designed to involve students on a visceral as well as an intellectual level with issues which are difficult to explore in a lecture format. Talking about rational as opposed to emotional decision-making is dry and uninvolving; experiencing it, particularly with classmates one knows, forces students to become active participants in the educational process. In a group setting, students often function in a teaching as well as a learning role, an experience which has proven academic benefits. Groups also give students the opportunity to work together in the type of cooperative problem-solving venture which is so common in the workplace.

A final group activity was integrated into the testing process. The second midterm included an essay question about the changing history of the family in America. The control group was given the question as a take-home exam; the students in the experimental class were divided into assigned groups and were told to use their books and discussion with other group members to answer the question in class. The class was instructed to turn in one answer for each group. Whereas members of the control group were given three days to answer the question but were admonished to work alone, members of the experimental group were allowed to work together but were required to answer the question during the class session. Nevertheless, the experimental group did significantly better on that examination (an average score of 37.4 as opposed to 30.8).

Students in the experimental group were also frequently encouraged to study together, particularly on those occasions when the instructor was scheduled to miss class. They often did so and a core group of four to six students emerged which studied together on a regular basis. They informed others of their plans and attracted several different students at various times during the semester. On one occasion, they even met in the park for a picnic and study session. Students in the control group were also encouraged to come to class for study groups, but no one ever did. There was, however, one student in that group who had friends in the 10:00 class with whom she occasionally studied.

Data collection focused on several different variables in addition to the GPA scores, the Coopersmith Inventory scores and the student survey results mentioned earlier. The major ones were mean test scores, retention rates and attendance although no-show rates turned out to be significant. In addition, attention was paid to such factors as the average number of quizzes missed by students in each class and the number of students who turned in extra credit assignments.

Although a great deal of data was gathered, the study has its limitations. It is primarily limited by the fact that it only applies to two classes in a one semester period of time. Replication is required before it can be determined whether or not the findings are universal. In addition, there are some technical improvements which should be implemented if the study is replicated. The quizzes and the final examination were strictly comprised of multiple-choice questions, but the three midterms averaged approximately two-thirds of the points in essay questions and one-third in multiple-choice questions. Combined scores were recorded, but it would have been more informative to have recorded the essay scores separately. Also, the Coopersmith Inventory is obviously a measure of self-esteem even though it is not identified as such, and I question the reliability of some of the scores. Although it is emphasized that there is no "right" answer, several students indicated their conviction that certain answers were preferable to others.

In addition, although nothing was said, a few students seemed to feel uncomfortable with the use of this instrument and, in retrospect, I have concluded that it is too intrusive for an introductory general education class. I would not recommend using it in the future.

Although I had initially planned to contact all students who dropped out or were dropped from the experimental class, that did not prove to be a useful activity. In addition to the fact that some students could not be reached, it also became obvious that most students are only willing to give explanations which they define as acceptable. They are not going to reveal overly-personal information about their lives, and they are not, in most cases, going to tell the instructor about problems related to the class. Although that is the type of information which would be most useful, few students are willing to take on the responsibility of improving the academic environment. The actual risks are very limited, but the perceived risks are substantial. Perhaps this perception could be altered if a third party were to make the phone calls.

Statistical Data

For the set of data analyzed:

Population 1 is the population of students in the experimental group.
Population 2 is the population of students in the control group.

The sample from Population 1 is the 10:00 a.m. class.
The sample from Population 2 is the 9:00 a.m. class.

$\bar{x}$, $s^2$, and $p_1^*$ will represent sample data from Population 1.

$\bar{y}$, $s^2$, and $p_2^*$ will represent sample data from Population 2.

Test 1. Comparing Drop Rates

Population 1. From 56 to 43, a drop of 13.
Population 2. From 50 to 28, a drop of 22.

$H_o$: $\pi_1 - \pi_2 = 0$ There is no difference in the proportions of students that dropped.

$H_a$: $\pi_1 - \pi_2 < 0$ There are fewer students that dropped from the experimental group than the control group.

The level of significance will be 5%.

The test statistic will be

$$Z = \frac{p_1^* - p_2^*}{\sqrt{\frac{p_1^*(1-p_1^*)}{n_1} + \frac{p_2^*(1-p_2^*)}{n_2}}}$$

If $Z < z_c$ (=-1.65), then reject $H_o$.

For the given data: $p_1^* = \frac{13}{56} = 0.232$

$p_2^* = \frac{22}{50} = 0.440$

$$Z = \frac{0.232 - 0.440}{\sqrt{\frac{(0.232)(0.768)}{56} + \frac{(0.440)(0.560)}{50}}} = -2.31$$

Since -2.31 < -1.65, reject $H_o$. That is, there is sufficient evidence, with $\alpha = 0.05$, to force the conclusion that the proportion of students that dropped from the experimental class is significantly less than the proportion that dropped from the control class.

Test 2. Comparing the Means of the Two Populations Based on the Total Points Possible for the Semester

$\mu_1$ = the mean of Population 1.
$\mu_2$ = the mean of Population 2.

$H_0$: $\mu_1 - \mu_2 = 0$ There is no difference in the means.
$H_a$: $\mu_1 - \mu_2 > 0$ The mean of Population 1 is greater than the mean of Population 2.

The level of significance will be 5%. That is, $\alpha = 0.05$.

The test statistic will be

$$Z = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

If $Z > z_\alpha$ (=1.65), then reject $H_0$.

For the given data, $n_1 = 41$, $\bar{x} = 245.7$, $s_1^2 = 1575.57$
$n_2 = 25$, $\bar{y} = 226.0$, $s_2^2 = 1872.12$

$$Z = \frac{245.7 - 226.0}{\sqrt{\frac{1575.57}{41} + \frac{1872.12}{25}}} = 1.85$$

Since 1.85 > 1.65, reject $H_0$. That is, there is sufficient evidence to force the conclusion that the experimental group did better than the control group in semester averages.

Test 3. Comparing the Mean Scores on the Student Questionnaire

$H_o$: $\mu_1 - \mu_2 = 0$ There is no difference in the mean scores.
$H_a$: $\mu_1 - \mu_2 > 0$ The mean score on the experimental group is higher than the control group.

The level of significance will be 5%.

The test statistic will be

$$Z = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

If $Z > z_c$ (=1.65), then reject $H_o$.

With $\bar{x} = 2.82$, $s_1^2 = 1.056$, $n_1 = 453$, $\bar{y} = 2.66$, $s_2^2 = 2.146$, and $n_2 = 304$:

$$Z = \frac{2.82 - 2.66}{\sqrt{\frac{1.056}{453} + \frac{2.146}{304}}} = 1.651$$

The Z falls right on the value of $z_c$. Thus, although rejection of $H_o$ is not conclusive, there is strong evidence that the mean score on the student survey is greater for the experimental group than for the control group.

## FINDINGS

The findings of this study indicate that the approach used with the experimental group resulted in significant differences in attendance, retention and performance. The first and most notable difference was that of the no-show rate. A no-show is defined as a student who enrolls in a class but never attends. Forty students originally enrolled in the control class, eight of whom were no-shows. Forty-four students originally enrolled in the experimental class but only two failed to show. The only difference in the way the two groups were treated prior to the first day of class was that the students in the experimental group received welcoming letters by the instructor. There is little doubt that the letters played a significant role in encouraging students to attend class.

There were also substantial differences in retention and attendance rates. After students were added in the first two weeks, the control class grew to fifty students but twenty-two had either dropped out of class or had been dropped due to poor attendance by the end of the semester. The experimental class grew to fifty-six, thirteen of whom either dropped or were dropped out of class. This amounts to an attrition rate of 44% for the control group and 23% for the experimental group. In addition, another three students in the control group stopped attending after the deadline for dropping classes. All students who were not dropped from the experimental group continued attending through the rest of the semester although two who were not passing the class failed to appear for the final examination. Among those students who remained enrolled, the average number of absences in the control group was 7.2 compared to 4.7 in the experimental group. In addition, the experimental class had four students who missed no classes at all whereas the control group had only one student who could make that claim.

There was no significant difference in performance until after the first midterm, which was given the end of the seventh week of class. For the first six quizzes and the first midterm, scores fluctuated with each class periodically besting the other but with scores only occasionally differing significantly. After the sixth quiz the experimental class consistently performed in a superior manner. The student survey administered at the end of the semester revealed that students in this group were much more likely to study together and a comprehensive analysis of course data revealed that significantly more students in that group turned in optional extra credit assignments (57% as opposed to 32%). Because extra credit points can help raise a student's grade, the willingness to complete extra assignments was at least partially responsible for the difference in grades between the two classes. The average semester grade for this course in the control group was 2.0 compared to 2.6 for the experimental group. Perhaps more telling is the fact that 28% of those in the experimental group earned A's compared to 7% of those in the control group.

The following table compares the scores of the two groups for each of the eleven quizzes (Q1-Q11), the three midterms (T1-T3), and the final examination. It also provides cumulative total scores both before and after adding extra credit points. The highest score in each category has been underlined.

| | Q1 | Q2 | Q3 | Q4 | Q5 | T1 | Q6 | Q7 | Q8 | T2 | Q9 | Q10 | Q11 | T3 | FINAL | TOTAL | TOT.+EC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9:00 | 6.2 | 6.8 | 6.7 | 8.3 | 5.7 | 32.0 | 5.7 | 5.6 | 6.1 | 30.8 | 6.7 | 6.7 | 6.5 | 33.2 | 80.6 | 226.0 | 238.8 |
| 10:00 | 6.1 | 7.3 | 6.6 | 8.1 | 6.6 | 31.2 | 5.6 | 6.5 | 7.2 | 37.4 | 7.2 | 6.8 | 7.1 | 34.6 | 84.4 | 245.7 | 268.8 |

Although the student survey was administered only to gain insights which could not be obtained otherwise, a statistical analysis of the results suggests that there may be a quantifiable difference in the subjective experiences of students in the two groups. The findings are not conclusive, but they do produce strong evidence that this is a possibility. Therefore, from both a quantitative and a qualitative perspective, it appears that student performance and retention are positively affected by a personalized teaching approach combined with opportunities for group interaction. The no-show rate was substantially affected by letters to students, and both the retention rate and the attendance rate were significantly higher among the experimental group. Although there was no consistent difference in the mean scores of the first several exams, the scores of the experimental group surpassed those of the control group as the semester progressed. As there were no other identifiable intervening variables, I submit that the students in the experimental group were responding to specific personalized teaching strategies by identifying themselves as active participants in the educational process and performing accordingly.

SUMMARY

Many students are content to passively allow information to be fed to them and academic institutions have made only limited progress in persuading them to become active participants in their own education. A personalized teaching style combined with group interaction involves students in the learning process and gives them a stake in its success. This project was designed to systematically evaluate this process to determine whether or not the subjective sense of success could be shown to be quantifiably significant.

The control and experimental group in this study were similar in all observable respects except for the fact that they were taught differently. For that reason, I feel confident that the differences noted are due to the teaching strategies employed. The personalized teaching style impressed students in the experimental group from the beginning when they received the letter welcoming them to the class. That resulted in a 4.5% no-show rate for the experimental group as opposed to a 20% no-show rate for the control group. Phone calls to absent students improved the attendance rate and, by the end of the semester, the average student in the experimental group had missed 2.5 fewer class sessions than the average student in the control group. Retention rates were also affected in that almost twice as many of the students in the control group were dropped as compared to those in the experimental group.

Students in the experimental group also performed at a higher level after being in the class for several weeks. Although the scores of the two groups were roughly similar for the first seven weeks, those of the experimental group consistently surpassed those of the control group after that time. The most logical explanation is that members of that group were beginning to re-evaluate their role as students by redefining their degree of academic responsibility in more active terms. This group missed fewer quizzes than the other group (an average of 1.1 as opposed to 1.6), and they turned in more extra credit work. This was all reflected in their final scores both before and after adding in extra credit points.

The qualitative survey which was administered to both classes revealed that members of the experimental group felt much more connected to one another. They were much more likely to know more students in class, and they felt comfortable interacting with them. One interesting finding was that more of the students in the control group felt that their level of participation in class was either very high or high (37% vs. 21% in the experimental group) even though my observations were just the opposite.

Because this survey was administered at the end of the semester, it is possible that students in the two groups had developed different standards of what constitutes high and low levels of participation. Sixty-two percent of the students in the experimental group considered their level of participation to be average (compared to 26% of the control group) so the norm for participation in that class may have been so much higher than that found in the typical class that even active participants defined their activity as average.

Another interesting finding was that the average student in the control group had a higher level of self-confidence than the average student in the experimental group. Although I have serious reservations about the reliability of the Coopersmith Inventory scores, the difference they revealed was also reflected in the student survey. At the beginning of the semester, 74% of the respondents in the control group felt confident of their ability to succeed in a sociology class. Even though there is no statistically significant difference between that and the 64% of the experimental group who felt that way, these figures do correspond to the Coopersmith Inventory scores which revealed that control group students at the beginning of the semester had an average score which was five points higher than that of the students in the experimental group. By the end of the semester, the scores of both groups had risen, and the control group was still higher but only by 3.6 points, indicating that scores among students in the experimental group had improved more than those among students in the control group (4.5 vs 3.1 points). These differences are not large, but they do indicate that members of the experimental group entered the study with lower levels of self-confidence and were able to overcome that limitation in all areas of classroom success which could be measured.

The findings of this study support the proposition that education is a complex process which requires that teachers do more than master the subject matter. Learning is a process which occurs when students are involved and challenged, and the burden is on teachers to create an environment which encourages that. Effective learning is not a one-way process; there is a continuously-evolving relationship between students, their classmates and the instructor which must be constantly monitored and attended to in order to maintain the momentum. Learning is an exciting process for all involved when it is recognized as a reciprocal endeavor from which everyone benefits. Personalized teaching strategies make education more individual for students and more compelling for teachers. No class is like any other and semesters do not become indistinguishable.

All studies require replication, and this one is no exception. Personalized teaching styles and group activities are not unique to sociology so this model could be applied in virtually any discipline. Although this project is limited to a commuter community college, I would like to see it replicated in upper division classes and residential colleges as well. It would be interesting to see if group activities would have the same impact in classes in which many students already know each other. The experience of conducting this research has led me to think about teaching from a new perspective and despite having previously read several articles on classroom based research, I feel I have gained substantially by actively conducting my own study. I learned to think more intensely about how students respond to the material and to elicit their involvement in teaching their classmates. I also learned to think of the classroom and all of us in it as research subjects for the multitude of questions which have not yet been asked. The challenge now is to remain open to recognizing those questions.

APPENDIX A

January 18, 1989

Dear Student:

I'd like to welcome you to the Sociology 1A class which I'll be teaching this spring on Mondays, Wednesdays, and Fridays from 10:00-10:50. I've always been fascinated by the study of people and the social forces which affect our lives and I'd like to share that interest with you by relating course material to events in everyday life. I encourage you to share your ideas throughout the semester and assure you that I will make every effort to respond to them as I teach the class.

Should any problems arise which might affect this class, please feel free to contact me. I'm going to be out of the area from January 22-29, but any other time I can be reached at 1-288-3451. If you would prefer to call a local number, you can leave a message at 449-7401 and I will return your call. By working together I think we can make this an exciting and rewarding semester.

Enjoy your semester break and I'll look forward to meeting you when classes begin on January 30th.

Sincerely,

Tonie Hilligoss, MSW
Instructor, Sociology 1A

APPENDIX B

SOCIOLOGY 1A
STUDENT QUESTIONNAIRE

CLASS: 9am_____ 10am_____

Please answer the following questions by circling the appropriate answers. Your answers are anonymous and can in no way affect your grade. All questions pertain only to your Soc. 1A class. Be sure to mark whether you are in the 9:00 or 10:00 class. Thank you for your participation and please feel free to contact me next fall if you are interested in the results of this survey.

1. Do you feel that you know any students in class well enough to talk to?

yes,many yes,some yes,one no,none

2. Are any of them students you have met only as a result of being in this class?

yes,many yes,some yes,one no,none

3. Do you know any students in class well enough to study with?

yes,many yes,some yes,one no,none

4. Are any of them students you have met only as a result of being in this class?

yes,many yes,some yes,one no,none

5. How many different students have you actually studied with?

several some one none

6. Do you feel your level of interest in this class has been:

very high high average low very low

7. Do you feel your level of participation in this class has been:

very high high average low very low

8. In your life outside of this class, do you feel that what you have learned has been:

very useful somewhat useful of little or no use

(TURN PAGE OVER)

9. Do you take notes in class?

always usually sometimes rarely never

10. Do you do the assigned reading?

always usually sometimes rarely never

11. Have you turned in extra credit assignments?

more than one one none

12. Do you study for tests?

always usually sometimes rarely never

13. At the beginning of this semester, did you feel confident in your ability to succeed in a sociology class?

yes no uncertain

14. Do you now feel confident in your ability to succeed in a sociology class?

yes no uncertain

15. During this semester, has anyone else in your Soc 1A class assisted you in any way related to the objectives of this class (other than as a participant in required class activities)?

yes,several times yes,a few times yes,once no,never

16. During this semester, have you assisted anyone else in your Soc. 1A class in any way related to the objectives of this class (other than as a participant in required class activities)?

yes,several times yes,a few times yes,once no,never

COMMENTS:

# VIDEO TAPING OF SPEECH STUDENTS

A RESEARCH PROJECT CONDUCTED BY
CRAIG GROSSMAN
SCHOOL OF ARTS AND LANGUAGES
IRVINE VALLEY COLLEGE
SPRING SEMESTER 1989

## OVERVIEW

In the Spring of 1989, I undertook a research project at Irvine Valley College in the basic Public Speaking class. Students met for three hours a week and were taught the fundamentals of public speaking. Included were lectures on communication theory, listening, speech research, outlining, visual aids usage, and delivery skills. The students were instructed in the three types of speech presentation: informative, persuasive, and entertainment. Each student presented these three types of speeches in addition to a quiz and mid-term exam. Each speech was videotaped and students were provided with a written and oral critique, as well as a copy of their videotaped speech.

A control group was established in another basic public speaking class. The control group consisted of a similar number of students who received identical instruction and performed the same presentations and writing exercises, but were not videotaped.

The basic questions examined in the study were:

1) do students recognize strengths and weaknesses as a platform speaker through videotape analysis . . .

2) are students grades affected as the semester assignments progress through the use of videotape and subsequent critiques . . .

3) do students perceive videotaping as a useful tool or as an anxiety which hinders performance?

METHODOLOGY

Each of the classes performed three types of speeches that were graded. The videotaped students not only received a written critique of their speeches, but were also asked to review their videotaped speech with the instructor who then provided an oral critique.

Students were assigned grades on a 4.0 scale (4=A, 3=B, 2=C, 1=D, and 0=F) for each of their speeches and their written work. /Several sets of data were collected which included grades for Speeches #1 through #3 and final grades for overall class work. In addition, a t-test was run for both groups. Finally, the videotaped class wrote critiques of the positive and negative aspects of the project.

FINDINGS

The following results were obtained during the semester:

TABLE 1

| | Speech 1 | Speech 2 | Speech 3 | Final Grade |
|---|---|---|---|---|
| Experimental Group | 3.19 (.68) | 3.52 (.98) | 3.67 (.97) | 3.24 (1.09) |
| Control Group | 3.06 (.64) | 3.06 (1.30) | 2.67 (1.75) | 2.61 (1.24) |

NOTE: Table 1 includes mean Grade Point Average and (in parenthesis) standard deviation for all speeches and the final course grade.

Evaluation forms were collected from the videotaped group on the day of the final exam. These evaluation forms from the experimental group are presented in the Appendix.

SUMMARY

Data collected in this study shows that students made statistically significant gains in grades in the group that was videotaped. The videotaped group went from a 3.19 grade point average to a 3.67 G.P.A. by their final speech. The control group started at a lower grade point average and their speech grades did not increase, but rather decreased to a 2.67 G.P.A. It is also interesting to note that because of the increase in presentation grades, the videotaped overall final grades were a 3.24 G.P.A. versus the control group receiving a 2.61 G.P.A.

The data were subjected to several t-tests for the differences between independent group means. The computed t-test values were: .64, 1.28, 2.25, and 1.68 for control to experimental group compari- sons for Speech 1, Speech 2, Speech 3, and final grade. The only statistically significant t was for the comparison of the control and experimental means on Speech 3 ($P<.05$). In addition, the grades for all three speeches were combined. The t-test for the combined speeches were 1.96, which was statistically significant and indicated a higher mean for the experimental group.

A review of the data from the evaluation sheets shows positive responses to videotaping. Many students remarked that it actually did not cause anxiety but rather built their confidence, reaffirmed that the grading system was fair, and motivated them to practice more. In addition, the videotaped group understood their successes or faults by reviewing the videotapes for eye contact, rate of speaking, use of notes, and pronunciation. Furthermore, student retention was not adversely affected by the use of videotapes. There were no dropouts in the experimental group and there were two in the control group.

## Conclusions/Recommendations

It was obvious to me that videotaping provided the students a positive experience which resulted in better presentations. The videotaped class spent more time in the critical process of critiquing, thus were able to view and clearly understand their strengths and weaknesses. I was concerned that taping may have produced more anxiety, but in their evaluations the class felt it was not a hindrance. It also seemed that the videotaped class was more enthusiastic and their attendance was much better than the control group. A review of attendance showed the video group missing 1.5 classes per student throughout the semester as compared to 3 classes per student in the control group.

I enthusiastically support replication of this study and continued research measuring the relationship between the use of video equipment and successful development of platform speaking skills. If a positive relationship continues to be demonstrated I recommend that the speech lab be equipped with appropriate playback and monitor so that all students have access to equipment to review their speeches.

I also recommend that the Dean of Instruction and the Speech Department at IVC study a curriculum proposal for a laboratory class to be added to the department. This class would be patterned after our writing lab courses and would allow students additional assistance when writing speeches and reviewing presentations.

STUDENT COMMENTS

POSITIVE ASPECTS

Viewing the tape after my presentation gave me the opportunity to see myself as others see me. It was reassuring to hear that my volume and rate of speaking were acceptable and pleasant. I learned that I do not have as much eye contact with my audience as I thought and need to improve this aspect.

I found that viewing my first video tape helped to build my confidence for the second presentation. It also provided validation of the teacher's critique about loudness, smoothness from rehearsal and increased my incentive to give a professional presentation. It is very useful in the one's memory under pressure of what one did is inaccurate.

I noticed a marked improvement in my visual performance on my second speech. While viewing the tape of my first speech was a bit embarrassing as I noticed problems in my delivery. The tape clearly gave me a better indication of what I needed to do to improve my speech performance. I noticed that I looked at my note cards more often than I thought, that I made unwanted sounds when I smacked my lips together, and that I was not as smooth in my speech pattern as I wanted to be. All of these flaws in delivery I improved on in the second speech.

This was a very helpful process. During my first taped speech I counted 22 UHS and watched myself push my sleeves up continually. During my first speech my eye contact was very poor. The result of watching my first speech on video tape greatly improved my ability to speak in public. A very worthwhile project.

There are many advantages for the videotape. First of all comparing the critique sheet with out actual performance helped to clarify exactly what the messages meant, on the grading sheet. After watching yourself speak you can identify with how the others saw you as well. Another advantage is that when one gives a speech you can't see your body actions. Watching the tape shows your postures, tension, facial expressions, etc. that one could not see otherwise. I think the tape is most beneficial.

I felt it helped me to see the habit I have of smacking my lips! If I had never seen that on tape, Lord knows down the road someone would have critiqued me on it, in a more embarrassing situation.

Since public speaking is my major, I really value the experience of being taped, before I get into higher division classes.

I was given the ability to look objectively at my speech as a member of the audience. This enabled me to see the good, as well as bad aspects of my presentations.

Extreme nervousness. This enabled me not to feel too comfortable with the classroom setting and to learn to control nervous tendencies.

I feel that this project was very beneficial in a lot of ways. First of all it allowed the speakers that were not very strong a chance to see what they could improve on. Secondly, the speakers that were good, gave a nice example for others.

Viewing the tape of my speech and other people's speeches helped to show the importance of eye contact and knowing your material. I think it was good not to know we were being taped the first time because I think this would have made us more nervous, but the next time I didn't even think about it.

Actually seeing my speeches after the fact with my critique sheet helped to know what exactly and where exactly in my speech the critique sheet was discussing. This helped me to know what I had to work on to get better.

At first when I heard that we were being video taped it bothered me, but after I saw the first video tape of my speech I could see what I did wrong, and it gave me more confidence for my next speech. I would definitely recommend the video taping in speech class.

Very helpful to see yourself after the speech was given. For example, in my speech I never realized how much I looked down at my note cards, and I also noticed I had good facial expressions and good eye contact when I wasn't looking at my cards so much.

It allowed me to see my mistakes. It encouraged me to practice more for the next speech.

I think it was beneficial in helping me to actually see my faults and in helping me to overcome them.

At first I though I'd be very self-conscience of the camera, but when I was up giving the speech I totally forgot about it. It really helped me to see what I was doing wrong so that on the persuasive speech, I knew what to be careful not to do.

It helped me to see where my weak areas were. I was then able to improve on those aspects and do a better job on the following speeches. The tapes also made me feel better about my presentations as I watched them afterwards. The helped me reconfirm that my grade was a fair and just grading system for the class. I enjoyed watching them. It did make a difference.

At times while giving a speech I felt that I was doing a very poor job. Being able to review a tape of my speech helped me to fine tune my style and gave me more confidence.

Video taping our speeches we gave is great. It really shows you what you need to work on. There is no wondering how you did. Video taping has helped me so much.

I thought it was great to be able to see myself speaking. It gave me an idea of what I am like while giving my speech, and it showed me what I need to correct.

NEGATIVE ASPECTS

I did not like finding out I had been video taped after the fact; however, I do appreciate the fact that it helped me to relax and become confident with the video process.

There are really no negative aspects to the video tape that I can tell, except maybe after you see yourself for the first time on tape and you realize how you performed it, can be discouraging, if your not happy with it.

First of all taping the class, I feel, was a success--but, it could have been a disaster if Craig wasn't such a positive and relaxed teacher. He made us feel comfortable and told us the feelings we were experiencing were natural and OK. No negative aspects from me.

I felt self-conscious as I began the second presentation, knowing the camera was on. However, I soon forgot about the camera. I really don't have any negative comments about this procedure. On the whole, it was definitely beneficial to me.

The only thing I really could see doing differently is not telling the speaker they are being taped because it made some people a little more nervous.

The only negative aspect is maybe a little anxiety on the second speech because I knew it was there, but it was nothing I couldn't over come.

I didn't find any negative aspect to it.

It's not easy to see facial expressions and to detect nervousness in voices. It may gave a false sense of security. This may be for the good or bad.

It would've been better if you had started by recording our first speech. Then we would've had more time to see what was going on.

None. I think it can only be beneficial, and it didn't make me anymore nervous.

# VIDEO TAPING OF SPEECH STUDENTS

A RESEARCH PROJECT CONDUCTED BY
KENNETH J. LYNCH
HUMANITIES AND FINE ARTS DIVISION
SACRAMENTO CITY COLLEGE
SPRING SEMESTER 1989

## OVERVIEW

During the Spring Semester 1989, Craig Grossman of Irvine Valley College and Kenneth Lynch of Sacramento City College undertook projects on the effectiveness of videotaping student speeches on their subsequent assignments.

While both projects were similar, they were not identical. Readers should note that Mr. Grossman's Experimental and Control Groups were both Speech 1 classes from the regular day program. Mr. Lynch's Groups came from night classes and, because of his responsibilities as Grievance Chair and Negotiations Chair for the Los Rios Federation of Teachers, from Speech 1 classes in two different semesters.

In addition, Mr. Grossman's third assignment was an unlimited preparation speech (Entertainment Speaking) while Mr. Lynch's was a limited preparation (Extemporaneous) speech. Speech teachers will recognize the inherent differences in content mastery, organization, and delivery styles between these two speeches. Differences between the urban campus of Sacramento City College and the suburban campus of Irvine Valley College may also have had an effect on the projects.

Other minor differences which might have had an effect on the results are noted in the reports. However, despite the differences, the results are quite similar.

Description

In the Spring of 1989, I undertook a research project at Sacramento City College in my Speech 1 class. The class was an evening class which met from 7:00 - 8:15 p.m. on Tuesday and Thursday nights. It was composed primarily of re-entry students who worked full time while attending night classes. Instruction was provided on the fundamentals of public speaking including lectures on the theory of public address, organization, outlining, research methods, use of audiovisual aids, and presentational skills.

This class became the Experimental Group.

In order to have a Control Group, I used the records of my Speech 1 class from the previous semester. That class had been almost identical to the current class. A check of the mean Grade Point Average for the two classes following the Spring 1989 semester showed the Control Group with a 3.14 GPA while the Experimental Group had a 2.82 GPA.

Students in both classes were asked to prepare and deliver three graded speeches in the project. The first was an Informative speech, the second, a Persuasive speech, and the third, an Extemporaneous speech.

In addition, the Experimental Group was asked to provide a videotape for recording the speeches. In addition to lectures and critiques, the Experimental Group was asked to view their own individual tapes and evaluate them on the basis of 1) adherence to time limits, 2) eye contact, 3) movement and gestures, 4) fluency in delivery, and 5) organization.

METHODOLOGY

Students in both classes were assigned letter grades based on A=4, B=3, C=2, D=1, and F=0. The instructor recorded grades to the nearest tenth (i.e., 3.2, 3.7, 2.6 = B, B+ and C-). Students in the Experimental Group were also asked to do a self-evaluation of the same scale. Criteria for evaluation were:

1) Adherence to Time Limits
2) Eye Contact
3) Movement and Gestures
4) Fluency
5) Organization

Several sets of data were obtained and analyzed. Basically, the project examined the same questions as the Grossman Project:

1) Does videotaping help a student recognize his or her successes or faults as a platform speaker?

2) Does videotaping affect the grades as the semester progresses?

3) Do students identify videotaping as a useful tool or as an anxiety hindrance?

It should be noted that in the Grossman study, students in both groups received individual critiques along with the tape. In the Lynch study, the Experimental Group received the tape with only a general class discussion of the assignment.

Despite the two approaches (instructor guidance versus self-evaluation), the results were similar.

FINDINGS

Data

Analysis, evaluation, conclusions, and suggestions were based on the following data collected from the two groups. Statistical significance through "T tests" was provided by Gene Sellers of the Mathematics Department of Sacramento City College.

| | | |
|---|---|---|
| Control Group: | 45 Enrolled | |
| | 5 Drops | |
| | 9 Incompletes | |
| | 31 Completed the Class | |
| Experimental Group: | 31 Enrolled | |
| | 6 Drops | |
| | 2 Incompletes | |
| | 23 Completed the Class | |
| Informative Speech (1) | Control Group | 3.3 |
| | Experimental Group | 2.9 |
| Persuasive Speech (2) | Control Group | 3.5 |
| | Experimental Group | 3.5 |
| Extemporaneous Speech (3) | Control Group | 3.4 |
| | Experimental Group | 3.4 |

An analysis of the grades received on the three assignments reveals that the Experimental Group showed a marked improvement from Speech 1 to Speech 2 with all other comparisons being equal.

| | | |
|---|---|---|
| Population 1: | Experimental Class | Spring 1989 |
| Population 2: | Control Class | Fall 1988 |

Test 1. Compare the mean scores of Exposition Exercise

$H_0$: $\mu_1 - \mu_2 = 0$ There is no difference in the mean scores.

$H_a$: $\mu_1 - \mu_2 > 0$ The mean score of Experimental Class is greater than the mean score of Control Class.

The test statistic will be:

$$T = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2}} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where the t-distribution has $n_1 + n_2 - 2$ degrees of freedom.

| For Population 1: | For Population 2: |
|---|---|
| $n_1 = 23$ | $n_2 = 31$ |
| $\bar{x}_1 = 2.88$ | $\bar{x}_2 = 3.30$ |
| $s_1^2 = 0.25$ | $s_2^2 = 0.18$ |

$$T = \frac{2.88 - 3.30}{0.126...} = -3.333$$

For 23 + 31-2 = 52 degrees of freedom and a one-tail test, $t_\alpha = 1.645$ for a 5% level of significance.

Since -3.333 < 1.645, do not reject $H_0$. There is not sufficient evidence to conclude that the experimental class did better than the control class. (The evidence suggests the control class did significantly better than the experimental class).

Test 2. Compare the mean scores of Persuasive Exercise

$H_0$: $\mu_1 - \mu_2 = 0$ There is no difference in the mean scores.

$H_a$: $\mu_1 - \mu_2 > 0$ The mean score of Experimental Class is greater than the mean score of Control Class.

The same test statistic will be used as in Test 1.

| For Population 1: | For Population 2: |
|---|---|
| $n_1 = 23$ | $n_2 = 31$ |
| $\bar{x}_1 = 3.51$ | $\bar{x}_2 = 3.49$ |
| $s_1^2 = 0.12$ | $s_2^2 = 0.09$ |

$$T = \frac{3.51 - 3.49}{0.088...} = -0.227$$

For 23 + 31-2 = 52 degrees of freedom and a one-tail test, $t_c = 1.645$ for a 5% level of significance.

Since $-0.227 < 1.645$, do not reject $H_0$. There is not sufficient evidence to conclude that the experimental class did better than the control class.

Test 3. Compare the mean scores of Extemporaneous Exercise

$H_o$: $\mu_1 - \mu_2 = 0$ There is no difference in the mean scores.

$H_a$: $\mu_1 - \mu_2 > 0$ The mean score of Experimental Class is greater than the mean score of Control Class.

The same test statistic will be used as in Test 1.

| For Population 1: | For Population 2: |
|---|---|
| $n_1 = 22$ | $n_2 = 31$ |
| $\bar{x}_1 = 3.42$ | $\bar{x}_2 = 3.40$ |
| $s_1^2 = 0.13$ | $s_2^2 = 0.14$ |

$$T = \frac{3.42 - 3.40}{0.103...} = -0.195$$

For $22 + 31 - 2 = 52$ degrees of freedom and a one-tail test, $t_c = 1.645$ for a 5% level of significance.

Since $-0.195 < 1.645$, do not reject $H_o$. There is not sufficient evidence to conclude that the experimental class did better than the control class.

Additional Data

Other data which may be of interest to readers included an evaluation of the Experimental Group speeches by two other community college speech instructors and a reaction to the videotaping by members of the Experimental Group.

1) Two other community college speech instructors viewed the videotapes of ten of the students from the Experimental Group chosen randomly. They viewed five of them in a 1-2 sequence and five in a 2-1 sequence. Each had a reverse sequence from the other and neither was aware of the sequence. In all cases, the evaluations of the two instructors matched these of Mr. Lynch with regard to the better speech. Analysis of the criteria involved showed:

   1) Adherence to Time Limits

      Instructor A — 7 better, 2 no change, 1 worse
      Instructor B — 7 better, 2 no change, 1 worse

   2) Eye Contact

      Instructor A — 10 better
      Instructor B — 9 better, 1 no change

   3) Gestures & Movement

      Instructor A — 5 better, 4 no change, 1 worse
      Instructor B — 6 better, 3 no change, 1 worse

   4) Fluency

      Instructor A — 6 better, 3 no change, 1 worse
      Instructor B — 7 better, 1 no change, 2 worse

   5) Organization

      Instructor A — 8 better, 1 no change, 1 worse
      Instructor B — 9 better, 1 worse

2) Student reactions to videotaping:

   While the students were reluctant when first informed of the project, they became less apprehensive when assured that they would have complete control of their own tapes. I felt that they were nervous during the first taping with a conscious reaction to the camera and what they felt was its range. However, their consensus after the class was that it was a worthwhile experience.

One item which I think is worth noting is that only one student did not have a VCR available at his/her home for viewing.

With 19 students responding, the following information was obtained. Seventeen felt it was a positive experience. Sixteen viewed their tapes more than once. Eighteen felt it helped on subsequent speeches. Fourteen allowed others to view the tape. And seventeen felt the taping should be continued in future classes.

STUDENT COMMENTS

The following comments were extracted from student evaluations:

"After watching my speech on videotape, I came to several points I could improve on. The first is speaking louder and more clearly."

"My speech was too unorganized."

"Although the speech was supposed to be between eight and ten minutes in length, my speech was only six and a half minutes."

"I feel that my appearance might have lacked a little something considering I wore shorts and a T-shirt."

"I felt there was sufficient eye contact this time. More than most, and I looked at everyone in the class--except YOU."

"Public speaking is not something I look forward to. However, when I viewed this speech I found I had done a better job than I expected. While I was reasonably pleased, there were some areas that could have been better. The most obvious of these was the lack of sufficient eye contact."

"I made other mistakes. The first I noticed was that I leaned on the podium. This was entirely subconscious."

"I do feel there was an improvement over the first speech."

"I don't feel my voice projects very well. Not must fluctuation in my voice, although it does get better towards the end."

SUMMARY

## Conclusions

In addition to those conclusions based on the statistical analysis, namely the lack of any evidence that videotaping produced better student speeches or reduced anxiety, I feel that several positive elements were present in the Experimental Group. The Experimental Group had a much better record regarding both attendance and readiness for assignments. They also had a much higher concern for appearance.

The Experimental Group seemed much more aware of what other students were doing and offered much more constructive criticism. The camera seemed to make the students aware of the effects of outside noises and hence they were much more attentive.

It also seems apparent that individual critiques by the students of their own speeches need immediate feedback from the instructor if they are to be of optimum value.

## Recommendations

Despite the statistical analysis, I feel that videotaping will become more and more important in speech classes. It is significant that both studies (Grossman and Lynch) involved "post-presentational" use of tapes. Students were asked to improve on an entertainment or extemporaneous speech on the basis of tapes of informative and persuasive speeches.
There are many other variables that can affect success or failure with regard to those different types of speeches.

It is quite probable that "pre-presentational" use of videotaping would be more valuable in improving student speeches.

Speech Departments should establish audiovisual laboratories which would allow students to use either approach in mastering Speech 1 and other communication classes.

Schools with strong forensics programs could easily provide tutors for such labs.

Precautions

Perhaps it's ego? Perhaps it's twenty-five years of teaching? At any rate, readers should take some of the following precautions regarding this or any classroom based research.

First, the very fact that students are aware they are taking part in a unique or experimental project can serve as a motivational force. Second, when subjective evaluations are involved, initial grades may be lower (subconsciously of course) allowing more room for growth.

Third, Fall Semester classes are often more highly motivated, having just completed a summer vacation. And, finally, as I get older I seem less authoritative and demanding in my evaluations. Any or all of these factors may have affected this project???

SACRAMENTO CITY COLLEGE/IRVINE VALLEY COLLEGE

COOPERATIVE CLASSROOM BASED RESEARCH

Exhibits

A. Announcement and Application

B. List of Selected Projects

C. Evaluation Instrument

D. Summary Evaluation Responses

E. Project Review Sheet

EXHIBIT A

Sacramento City College/Irvine Valley College

# COOPERATIVE CLASSROOM BASED RESEARCH PROJECT

**• Introduction**

Sacramento City College, in conjunction with Irvine Valley College, has been awarded a grant to support six classroom based research projects. Three of the six projects will be done in collaboration with faculty at Irvine Valley College.

**• Project Intent**

To improve teaching and learning through classroom based research.

**• Project Purpose**

To study teaching methodologies and /or classroom activities that can have an impact on learning. The focus of this project is on a teaching method that an instructor is already using (or may want to try) that he/she feels may improve students' chance of success.

To illustrate, the use of computer enhancement in a course may be evaluated. Or, the advantage of students bonding together for support may be another type of project. This is the opportunity to have such projects put into a research design for validation.

**• Project Specifics**

Six instructor will work during Spring 1989 conducting classroom based research to improve teaching and learning.

The activity will include three workshops prior to the start of the Spring Semester, 1989. There will be continuous individualized assistance for conducting classroom based research throughout the project. This assistance will help the participant in the project decide on an appropriate research model.

**• Faculty Selection**

Instructors will be chosen from applications submitted to the project steering committee.

**• Application Deadline**

Sept. 15 to Oct.1 is the timeframe for application submission. Selected instructors will be notified by Oct. 15, 1988.

**• Stipend**

Participants will each be awarded a $1,000 stipend to compensate them for the extra time they will need to commit to the project.

**• Questions**

**For additional information, please contact:**

| | | |
|---|---|---|
| Marguerite Jones | Learning Resources Division | Ext. 253 |
| Gene Sellers | Science/Math/Engineering | Ext. 267 |
| Kirk Wiecking | Learning Center | Ext. 361 |

A project funded by California Community College Fund for Instructional Improvement

Sacramento City College/Irvine Valley College

# Cooperative Classroom Based Research

## PROJECT APPLICATION

Name _____ Phone _____

Division _____

Briefly describe your idea for a classroom based research project you would like to conduct during Spring 1989.

**Please Forward Completed Application By December 7, 1988**

Supported by a grant from the California Community
College Fund For Instructional Improvement

## MATHEMATICS

Partial Credit With Notes And Rework For Half Credit In Math

Richard Zucker--Irvine Valley College

## MUSIC

Electornic Music Literacy

Janice Lynn Wyma--Irvine Valley College

## PHYSICAL EDUCATION

Dunham Dance Technique To Improve Student Preparedness For Dance

Shirley Brown--Sacramento City College

A Comparison Of Two Different Methods Of Motivating Students to Improve Their Physical Fitness Levels

Pam Deegan--Irvine Valley College

## SOCIAL SCIENCE

Self-Definition As A Factor In Student Success

Tonya Hilligoss--Sacramento City College

## SPEECH

Videotaping Of Speech Students

Craig Grossman--Irvine Valley College

Videotaping Of Speech Students

Kenneth J. Lynch--Sacramento City College

EXHIBIT B

## FACULTY RESEARCH REPORTS

### BIOLOGY

Testing Strategies In Biology To Measure Student Ability For Levels of Abstraction Work

Johnathan Brosin -- Sacramento City College

Student Analytical Ability In Biology

K. Christopher Riegle--Irvine Valley College

### CHEMISTRY

Is Writing An Effective Way To Learn Chemical Concepts?

Naola VanOrden--Sacramento City College

### COUNSELING

A Second Look: Student Persistence And Achievement: An Evaluation Of The Effects Of An Extended Orientation Course

Edwin Stupka--Sacramento City College

### ENGLISH

The MBTI In The College Writing Class

Donovan Johnson--Irvine Valley College

EXHIBIT C

SACRAMENTO CITY COLLEGE
CLASSROOM BASED RESEARCH
EVALUATION

1. What is your opinion of the Classroom Based Research concept to improve teaching and learning?

| Excellent Idea | Very Good Idea | Good Idea | Needs Refinement | Not Appropriate |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

2. From a professional growth perspective the value of classroom based research to you was

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

3. Your level of satisfaction with your study was

| Extremely Satisfied | Very Satisfied | Satisfied | Not Very Satisfied | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 5 | 4 | 5 |

4. The value of classroom based research for SCC to improve teaching and learning is

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

5. As a result of your findings related to the topic of study, adjustments in your teaching strategies will be

| Extremely Likely | Very Likely | Likely | Not Very Likely | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

6. Considering the student outcomes of your study what you learned is

| Extremely Useful | Very Useful | Useful | Not Very Useful | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

7. Your interest in this activity is

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

8. The potential for you to continue classroom based research study is

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

9. Conducting classroom research is

| Extremely Difficult | Very Difficult | Difficult | Not Very Difficult | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

10. How interested do you think other faculty may be in conducting classroom research studies?

| Extremely Interested | Very Interested | Interested | Not Very Interested | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

11. The potential benefits to colleagues who become involved in classroom based research are

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

12. Of your colleagues who were aware of your study their level of interest was

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

13. Colleagues who participated in your study were

| More Than Accommodating | Very Accomod. | Accomod. | Not Very Accomod. | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

14. The emphasis on quantitative research versus qualitative research is

| More Than Sufficient | Very Sufficient | Sufficient | Less Than Sufficient | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

15. Your interest in sharing your experiences with other colleagues is

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

16. Would you recommend classroom based research studies be part of on-going staff development?

| A Major Part | Considerable Part | Some Part | Minor Part | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

17. Conducting classroom based research for a sabbatical or release time activity would be an

| Excellent Idea | Very Good Idea | Good Idea | Not A Good Idea | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

18. Compared to other salary the stipend you received for your efforts was

| Well Above The Norm | Above Norm | Equitable | Below Norm | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

19. Conducting seminars/workshops on classroom research for college faculty would be

| Extremely Useful | Very Useful | Useful | Not Very Useful | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

20. The project was

| Very Well Organized | Well Organized | Organized | Not Very Well Organized | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

21. The scope of your project was

| Too Extensive | Very Extensive | Manageable | Not Very Extensive | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

22. Time provided to conduct the study was

| More Than Sufficient | Very Sufficient | Sufficient | Less Than Sufficient | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

23. The need for clerical assistance is

| Extremely Important | Very Important | Important | Not Very Important | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

24. The clerical assistance was

| Excellent | Very Good | Good | Not Very Good | Not Applicable |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

25. Contact by the project director should have been made

| Much More Frequently | More Frequently | As They Were | Less Frequently | Not at All |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

26. One to one consultations with the internal research advisor were

| Extremely Helpful | Very Helpful | Helpful | Not Very Helpful | Not Appropriate |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

27. Group meetings should have been conducted

| Much More Frequently | More Frequently | As They Were | Less Frequently | Not at All |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

28. The greatest need for assistance in conducting classroom based research is

(Please rank (1 highest, 5 lowest) in order of importance to you what assistance would be of value to you)

_____ Clerical
_____ Data Compilation
_____ Statistical Treatments
_____ Report Preparation
_____ Research Design

29. What was the most significant part of the study for you?

_____
_____

30. The least significant?

_____
_____

31. Other comments?

_____
_____
_____

EXHIBIT D

SACRAMENTO CITY COLLEGE
CLASSROOM BASED RESEARCH
EVALUATION

1. What is your opinion of the Classroom Based Research concept to improve teaching and learning?

| Excellent Idea | Very Good Idea | Good Idea | Needs Refinement | Not Appropriate |
|---|---|---|---|---|
| 10/12 | 1/12 | 1/12 | | |
| 1 | 2 | 3 | 4 | 5 |

2. From a professional growth perspective the value of classroom based research to you was

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 4/12 | 7/12 | 1/12 | | |
| 1 | 2 | 3 | 4 | 5 |

3. Your level of satisfaction with your study was

| Extremely Satisfied | Very Satisfied | Satisfied | Not Very Satisfied | Not Applicable |
|---|---|---|---|---|
| | 6/12 | 5/12 | 1/12 | |
| 1 | 2 | 5 | 4 | 5 |

4. The value of classroom based research for SCC to improve teaching and learning is

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 4/12 | 5/12 | 3/12 | | |
| 1 | 2 | 3 | 4 | 5 |

5. As a result of your findings related to the topic of study, adjustments in your teaching strategies will be

| Extremely Likely | Very Likely | Likely | Not Very Likely | Not Applicable |
|---|---|---|---|---|
| 3/12 | 7/12 | 2/12 | | |
| 1 | 2 | 3 | 4 | 5 |

6. Considering the student outcomes of your study what you learned is

| Extremely Useful | Very Useful | Useful | Not Very Useful | Not Applicable |
|---|---|---|---|---|
| 4/12 | 4/12 | 4/12 | | |
| 1 | 2 | 3 | 4 | 5 |

7. Your interest in this activity is

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 7/12 | 5/12 | | | |
| 1 | 2 | 3 | 4 | 5 |

8. The potential for you to continue classroom based research study is

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 5/12 | 5/12 | 2/12 | | |
| 1 | 2 | 3 | 4 | 5 |

9. Conducting classroom research is

| Extremely Difficult | Very Difficult | Difficult | Not Very Difficult | Not Applicable |
|---|---|---|---|---|
| | | 6/12 | 6/12 | |
| 1 | 2 | 3 | 4 | 5 |

10. How interested do you think other faculty may be in conducting classroom research studies?

| Extremely Interested | Very Interested | Interested | Not Very Interested | Not Applicable |
|---|---|---|---|---|
| | 3/12 | 8/12 | 1/12 | |
| 1 | 2 | 3 | 4 | 5 |

11. The potential benefits to colleagues who become involved in classroom based research are

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 2/12 | 8/12 | 2/12 | | |
| 1 | 2 | 3 | 4 | 5 |

12. Of your colleagues who were aware of your study their level of interest was

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| | 4/12 | 5/12 | 3/12 | |
| 1 | 2 | 3 | 4 | 5 |

13. Colleagues who participated in your study were

| More Than Accommodating | Very Accomod. | Accomod. | Not Very Accomod. | Not Applicable |
|---|---|---|---|---|
| 4/12 | 1/12 | 1/12 | | 6/12 |
| 1 | 2 | 3 | 4 | 5 |

14. The emphasis on quantitative research versus qualitative research is

| More Than Sufficient | Very Sufficient | Sufficient | Less Than Sufficient | Not Applicable |
|---|---|---|---|---|
| | 3/12 | 7/12 | 1/12 | 1/12 |
| 1 | 2 | 3 | 4 | 5 |

15. Your interest in sharing your experiences with other colleagues is

| Extremely High | Very High | Average | Not Very High | Not Applicable |
|---|---|---|---|---|
| 2/12 | 8/12 | 2/12 | | |
| 1 | 2 | 3 | 4 | 5 |

16. Would you recommend classroom based research studies be part of on-going staff development?

| A Major Part | Considerable Part | Some Part | Minor Part | Not Applicable |
|---|---|---|---|---|
| 6/12 | 6/12 | | | |
| 1 | 2 | 3 | 4 | 5 |

17. Conducting classroom based research for a sabbatical or release time activity would be an

| Excellent Idea | Very Good Idea | Good Idea | Not A Good Idea | Not Applicable |
|---|---|---|---|---|
| 4/12 | 5/12 | 3/12 | | |
| 1 | 2 | 3 | 4 | 5 |

18. Compared to other salary the stipend you received for your efforts was

| Well Above The Norm | Above Norm | Equitable | Below Norm | Not Applicable |
|---|---|---|---|---|
| 1/12 | 1/12 | 8/12 | 2/12 | |
| 1 | 2 | 3 | 4 | 5 |

19. Conducting seminars/workshops on classroom research for college faculty would be

| Extremely Useful | Very Useful | Useful | Not Very Useful | Not Applicable |
|---|---|---|---|---|
| 2/12 | 6/12 | 4/12 | | |
| 1 | 2 | 3 | 4 | 5 |

20. The project was

| Very Well Organized | Well Organized | Organized | Not Very Well Organized | Not Applicable |
|---|---|---|---|---|
| 2/12 | 7/12 | 3/12 | | |
| 1 | 2 | 3 | 4 | 5 |

21. The scope of your project was

| Too Extensive | Very Extensive | Manageable | Not Very Extensive | Not Applicable |
|---|---|---|---|---|
| | 2/12 | 9/12 | 1/12 | |
| 1 | 2 | 3 | 4 | 5 |

22. Time provided to conduct the study was

| More Than Sufficient | Very Sufficient | Sufficient | Less Than Sufficient | Not Applicable |
|---|---|---|---|---|
| | 2/12 | 9/12 | 1/12 | |
| 1 | 2 | 3 | 4 | 5 |

23. The need for clerical assistance is

| Extremely Important | Very Important | Important | Not Very Important | Not Applicable |
|---|---|---|---|---|
| 1/12 | 3/12 | 6/12 | 2/12 | |
| 1 | 2 | 3 | 4 | 5 |

24. The clerical assistance was

| Excellent | Very Good | Good | Not Very Good | Not Applicable |
|---|---|---|---|---|
| 2/12 | 3/12 | 2/12 | 1/12 | 4/12 |
| 1 | 2 | 3 | 4 | 5 |

25. Contact by the project director should have been made

| Much More Frequently | More Frequently | As They Were | Less Frequently | Not at All |
|---|---|---|---|---|
| | 1/12 | 11/12 | | |
| 1 | 2 | 3 | 4 | 5 |

26. One to one consultations with the internal research advisor were

| Extremely Helpful | Very Helpful | Helpful | Not Very Helpful | Not Appropriate |
|---|---|---|---|---|
| 6/12 | 2/12 | 4/12 | | |
| 1 | 2 | 3 | 4 | 5 |

27. Group meetings should have been conducted

| Much More Frequently | More Frequently | As They Were | Less Frequently | Not at All |
|---|---|---|---|---|
| | 5/12 | 7/12 | | |
| 1 | 2 | 3 | 4 | 5 |

28. The greatest need for assistance in conducting classroom based research is

(Please rank (1 highest, 5 lowest) in order of importance to you what assistance would be of value to you)

Composite Average

4 Clerical
5 Data Compilation
2 Statistical Treatments
3 Report Preparation
1 Research Design

29. What was the most significant part of the study for you?
Results; data interpretation; hands-on computer experience, personality differences in writing styles; significance of videotaping; new data preparation of materials for study; integrating teaching and research.

30. The least significant?
Statistics - preparing the report.

31. Other comments?
Program director and advisor should be allowed to continue program; appreciates support for professional development project.
Enjoyed would like to do again - would like to see more people involved.
Use release time instead of stipends.
Great way to involve instructors.
More research needs to be done.
Redefining role of teacher.

EXHIBIT E

SACRAMENTO CITY COLLEGE
CLASSROOM RESEARCH STUDY
CONCEPT REVIEW

RESEARCH STUDY_____

FACULTY APPLICANT _____

| | High Rank | Above Average | Average | Below Average | Low Rank | No Rank |
|---|---|---|---|---|---|---|
| 1. Appropriateness of research idea to improve teaching and learning | 5 | 4 | 3 | 2 | 1 | 0 |
| 2. Practicality/feasibility of research idea | 5 | 4 | 3 | 2 | 1 | 0 |
| * 3. Diversity of idea compared with other proposed ideas | 5 | 4 | 3 | 2 | 1 | 0 |
| * 4. Equitable representation of campus disciplines | 5 | 4 | 3 | 2 | 1 | 0 |
| 5. Completeness of idea | 5 | 4 | 3 | 2 | 1 | 0 |
| * 6. Potential for collaborative study | 5 | 4 | 3 | 2 | 1 | 0 |
| 7. Potential for replication | 5 | 4 | 3 | 2 | 1 | 0 |

Total points earned for research concept: _____

_____ Recommend Approval for Design

_____ Priority Rank

_____ Do Not Recommend

Comments: _____

_____

* TO BE RANKED IN COMMITTEE

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